GE Medical Systems

Technical Publications

Vivid 7/Vivid 7 PRO

CE 0470

User's Manual

Volume 1

GEVU #: FC092326

GEVU Rev. 03

Operating Documentation

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GE Medical Systems

MANUAL STATUS
FC092326-03
28/08/03

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COMPANY DATA

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Introduction

The Vivid 7/Vivid 7 PRO ultrasound unit is a high performance digital ultrasound imaging system.

The system provides image generation in 2D (B) Mode, Color Doppler, Power Doppler (Angio), M-Mode, Color M-Mode, PW and CW Doppler spectra, Tissue Velocity imaging and Contrast applications.

The fully digital architecture of the Vivid 7/Vivid 7 PRO unit allows optimal usage of all scanning modes and probe types, throughout the full spectrum of operating frequencies.

Attention

Read and understand all instructions in the User's Manual before attempting to use the Vivid 7/Vivid 7 PRO ultrasound unit. Keep the manual with the equipment at all time. Periodically review the procedures for operation and safety precautions.

△
CAUTION

For USA only:

United States law restricts this device to sale or use by, or on the order of a physician.

Safety

All information in Chapter 14, 'Safety' on page 461, should be read and understood before operating the Vivid 7/ Vivid 7 PRO ultrasound unit.

Interference caution

△
CAUTION

Use of devices that transmit radio waves near the unit could cause it to malfunction.

Devices not to be used near this equipment:

Devices which intrinsically transmit radio waves such as cellular phones, radio transceivers, mobile radio transmitters,

radio-controlled toys, and so on, should not be operated near the unit.

Medical staff in charge of the unit are required to instruct technicians, patients, and other people who may be around the unit, to fully comply with the above recommendations.

Indications for use

The Vivid 7/Vivid 7 PRO ultrasound unit is intended for the following applications:

- Abdominal
- Cardiac
- Small Organ
- Pediatric
- Fetal
- Transesophageal
- Transrectal
- Peripheral Vascular
- Neonatal
- Adult Cephalic

Contraindications

The Vivid 7/Vivid 7 PRO ultrasound unit is not intended for ophthalmic use or any use causing the acoustic beam to pass through the eye.

Manual contents

The Vivid 7/Vivid 7 PRO User's Manual is organized to provide the information needed to start scanning immediately.

If not otherwise specified, the functions described in this manual are common to both systems.

△
CAUTION

The safety instruction must be reviewed before operation of the unit.

Contents:

Introductory information

Introduction, provides the following information:

- General overview of the user manual
- Conventions used in the book
- Contact information

Getting started

Chapter 1, 'Getting started' on page 9 describes the following:

- 'Preparing the unit for use' on page 11
- 'System description' on page 26
- 'Starting an examination' on page 49

Scanning and related operations

Chapter 2, 'Basic scanning operations' on page 55 describes the following:

- 'Assignable keys and Soft Menu Rocker' on page 57
- 'Cineloop operation' on page 62
- 'Annotations' on page 82
- 'Zoom' on page 70
- 'Physiological traces' on page 73

Chapter 3, 'Scanning Modes' on page 89, describes the basic scan modes and the related controls.

Chapter 4, 'Stress Echo' on page 147, describes:

- Stress Echo application

Chapter 5, ’Contrast Imaging’ on page 185, describes the acquisition applications related to Contrast imaging:

- ’Left Ventricular Contrast Imaging’ on page 188
- ’Myocardial Contrast Imaging’ on page 194
- ’Real-Time Myocardial Contrast Imaging’ on page 202

Chapter 6, ’Cardiac Measurement and Analysis’ on page 209, describes the common conventions and functionality used for taking cardiac measurements.

Chapter 7, ’Quantitative Analysis’ on page 233, describes the analysis tools for quantification of TVI and Contrast related raw data.

Chapter 8, ’Archiving’ on page 269, describes the following:

- ’Storing images and cineloops’ on page 271
- ’Retrieving and editing archived information’ on page 279

Chapter 9, ’Report’ on page 335, describes report generation based on the examination performed and the analysis that were made during the examination

Additional Information

Chapter 10, ’Probes’ on page 355, describes the probes supported by the unit and care and maintenance.

Chapter 11, ’Peripherals’ on page 381, describes the VCR and video printers operation.

Chapter 12, ’Presets and System setup’ on page 391, describes the configuration management package of the Vivid 7/Vivid 7 PRO ultrasound unit, enabling the user to customize the global configuration for the unit and the application-specific settings.

Chapter 13, ’User maintenance’ on page 453, describes the procedure for maintaining the Vivid 7/Vivid 7 PRO ultrasound unit.

Chapter 14, ’Safety’ on page 461, provides safety instructions that are to be followed upon installation of the unit.

Finding information

Table of Contents, lists the main topics and their location.

Headers and Footers, give the chapter name and page number.

Index, provides an alphabetical and contextual list of topics.

Conventions used in this manual

2-column layout, the right column contains the main text. The left column contains notes, hints and warnings texts.

Keys and button, on the control panel are indicated by over and underlined text (ex. 2D refers to the 2D mode key)

Bold type, describes button names on the screen.

Italic type: describes program windows, screens and dialogue boxes.

Icons, highlight safety issues as follow:

DANGER

Indicates that a specific hazard exists that, given inappropriate conditions or actions, will cause:

- Severe or fatal personal injury
- Substantial property damage

WARNING

Indicates that a specific hazard exists that, given inappropriate conditions or actions, will cause:

- Severe personal injury
- Substantial property damage

CAUTION

Indicates that a potential hazard may exist that, given inappropriate conditions or actions, can cause:

- Minor injury
- Property damage

Contact information

If additional information or assistance is needed, please contact the local distributor or the appropriate support resource listed bellow:

Europe GE Ultraschall KG Deutschland GmbH & Co. Beethovenstraße 239 Postfach 11 05 60 D-42655 Solingen	 Tel: 0130 81 6370 Tel: (49) (0) 212-28-02-208
USA GE Medical Systems Ultrasound Service Engineering 4855 W. Electric Avenue Milwaukee, WI 53219 On-line Applications Support	 Tel: (1) 800-437-1171 Fax: (1) 414-647-4090 Tel: (1) 800-682-5327 or (262) 524-5698
Canada GE Medical Systems Ultrasound Service Engineering 4855 W. Electric Avenue Milwaukee, WI 53219 On-line Applications Support	 Tel: (1) 800-664-0732 Tel: (1) 800-682-5327 or (262) 524-5698
Asia GE Ultrasound Asia Service Department Ultrasound 298 Tiong Gahru Road # 15-01/06 Central Plaza Singapore 168730	 Tel: (65) 291-8528 Fax: (65) 272-3997

Latin and South America GE Medical Systems Ultrasound Service Engineering 4855 W. Electric Avenue Milwaukee, WI 53219 On-line Applications Support	 Tel: (1) 305-735-2304 Tel: (1) 800-682-5327 or (262) 524-5698
Brazil GE Ultrasound Rua Tomas Carvalhal, 711 Paraiso Cep: 04006-002 - São Paulo, SP	 Tel: (55.11) 887-8099 Fax: (55.11) 887-9948

Chapter 1
Getting started

This chapter includes the following information:

- **Preparing the unit for use 11**
  - Site requirements 11
  - Connecting the unit 12
  - Switching On/Off 18
- **Moving and transporting the unit 21**
  - Wheels 21
  - Moving the unit 23
  - Transporting the unit 24
  - Reinstalling at a new location 24
  - Unit acclimation time 25
- **System description 26**
  - System overview 26
  - Control panel 29
  - The Scanning screen 43
  - Footswitch operation 46
  - Connecting and disconnecting probes 47
  - Adjusting the display monitor 47
- **Starting an examination 49**
  - Creating a new Patient record or starting an examination from an existing patient record 49
  - Selecting a Probe and an Application 53

Introduction

Only qualified physicians or ultrasound sonographers should perform scans of patients for medical diagnostic reasons. Request training, if needed. Ensure that unauthorized personnel do not tamper with the unit.

Service representatives authorized by GE Ultrasound will unpack and install the unit. Do not attempt to install the unit alone.

WARNING

All the warnings in Chapter 14, 'Safety' on page 461, should be read and understood before operating the unit.

Never set liquids on the unit in order to avoid spillage into the unit or the control panel. Maintain a clean environment. Turn off the circuit breaker before cleaning the unit. Refer to 'System Care and Maintenance' on page 454 for cleaning instructions.

To carry out regular preventative maintenance refer to Chapter 13, 'User maintenance' on page 453.

Preparing the unit for use

The Vivid 7/Vivid 7 PRO ultrasound unit must operate within the proper environment and in accordance with the requirements described in this section. Before using the system, ensure that the requirements are met.

Site requirements

Optimal operation of the unit can be obtained by implementing the following requirements:

Power requirements

The Vivid 7/Vivid 7 PRO ultrasound unit uses a separate power outlet for 100–120 VAC or 230 VAC, 50–60 Hz.

WARNING

Operating the unit with the wrong voltage range causes damages, voiding the factory warranty.

Operating Environment

Ensure that there is sufficient air flow around the Vivid 7/ Vivid 7 PRO ultrasound unit when installed in a fixed location.

Environmental requirements

The Vivid 7/Vivid 7 PRO ultrasound unit requires constant maintenance of its operational environment. Different temperature and humidity requirements are specified for operation, storage and transportation.

Requirement	Temperature	Humidity	Air Pressure
Operational	10-40 ºC	30-85%	700-1060 hPa
Storage	-10-60 ºC	30-95%	700-1060 hPa
Transport	-10-60 ºC	30-95%	700-1060 hPa

Electromagnetic interferences

*The **Vivid 7/ Vivid 7 PRO** ultrasound unit is approved for use in hospitals, clinics and other environmentally qualified facilities, in terms of the prevention of radio wave interference. Operation of the unit in an inappropriate environment can cause electronic interference to radios and television sets situated near the medical equipment.*

Ensure that the unit is protected from electromagnetic interferences as follows:

- Operate the unit at least 4.5 meters (fifteen feet) away from equipment that emits strong electromagnetic radiation.
- Shield the unit when operating it in the vicinity of radio broadcasting equipment, if necessary.

Connecting the unit

A GE-qualified person should perform the initial system installation.

Connecting the Vivid 7/Vivid 7 PRO ultrasound unit involves preliminary checks of the power cord, voltage level and compliance with electrical safety requirements.

Use only power supply cords, cables and plugs provided by or designated by GE Medical Systems.

Ensure that the power cord and plug are intact and that the power plug is the proper hospital-grade type (where required).

The unit should be connected to a fixed power socket which has the protective grounding connector. Never use an extension cord or adapter plug.

⚠
WARNING

Failure to provide an adequate earth circuit can cause electrical shock, resulting in serious injury.

Voltage level check

Check the label near the circuit breaker on the rear side of the system (see Figure 1-1).

1. **Rating label**
2. **Circuit breaker**
3. **Power cable socket**
4. **Potential Equalization**

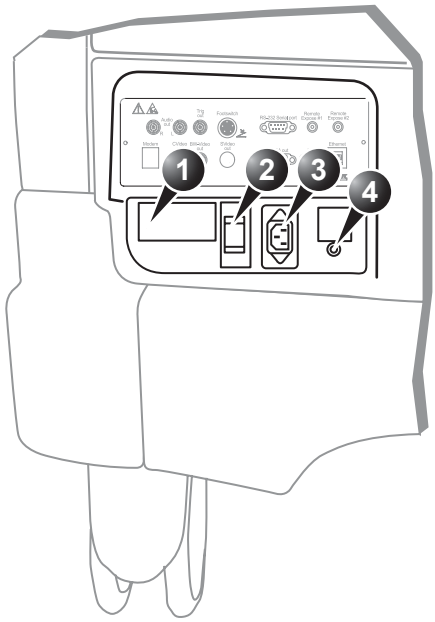


Figure 1-1: The rating label

Check the voltage range indicated on the label:

- 100–120 VAC, 50–60 Hz, 10A
  Or
- 230 VAC, 50–60 Hz, 5A

WARNING

If the mains supply is not within the specified range, do not connect the unit to the power source. Contact the dealer to have the unit adjusted to the specific mains supply.

Connecting to the electrical outlet

WARNING

POWER OUTAGE MAY OCCUR. The Vivid 7/Vivid 7 PRO requires a dedicated single branch circuit. To avoid circuit overload and possible loss of critical care equipment, make sure you DO NOT have other equipment operating on the same circuit.

The unit's power must be supplied from a separate, properly rated outlet to avoid risk of fire. Refer to 'Power requirements' on page 11 for rating information.

The power cord should not, under any circumstances, be altered to a configuration rated less than that specified for the current.

Do not use an extension cord or adapter plug.

1. Ensure that the wall outlet is of appropriate type, and that the power switch is turned off.
2. Uncoil the power cable, allowing sufficient slack so that the unit can be moved slightly.
3. Secure the power plug in the wall outlet.

Peripheral/Accessory connection

Refer to page 381 for further information on peripherals.

The external I/O connector is situated on the rear side of the unit See Figure 1-10.

WARNING

Accessory equipment connected to the analogue and digital interfaces must be certified according to the respective IEC standards (e.g. IEC 60950 for data processing equipment and IEC 60601-1 (1988) for medical equipment). Any person connecting additional equipment to the signal input part or output part is configuring the medical system, and is therefore responsible that the system complies with the requirements of the system standard IEC 60601-1-1 (2000). If in doubt, consult the technical service department or your local representative.

Do not touch the conducting parts of the USB or Ethernet cables when connecting equipment to the unit.

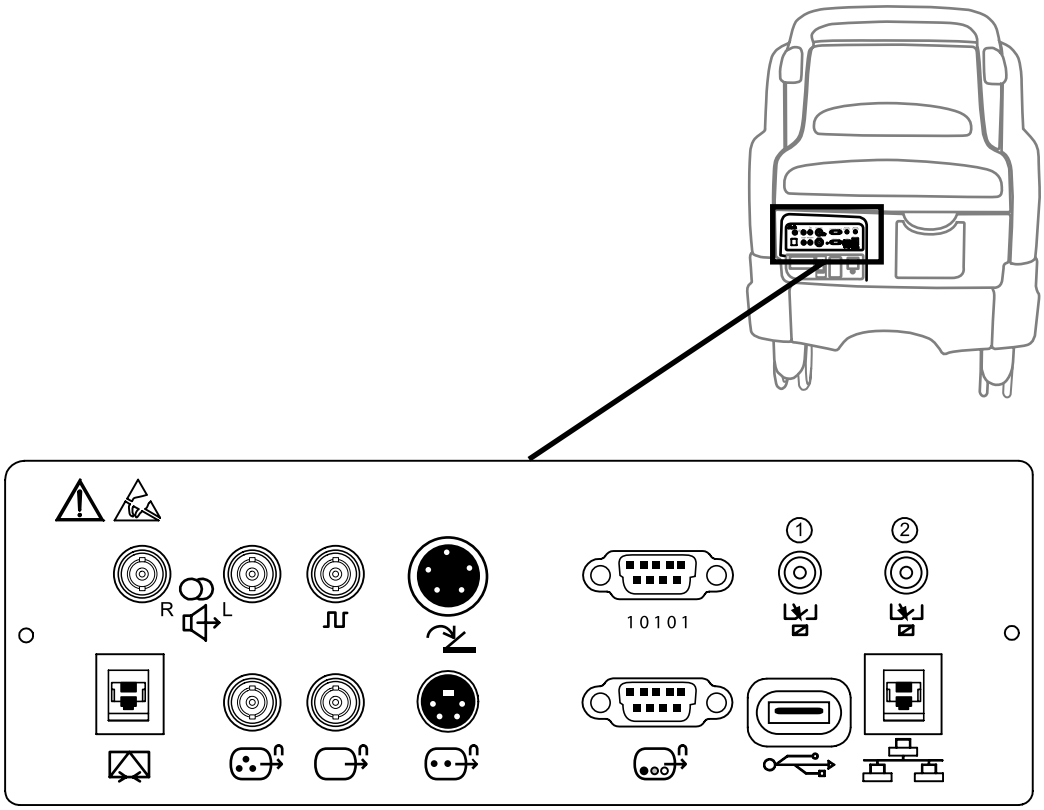
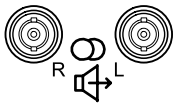
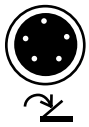
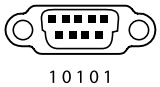
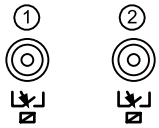
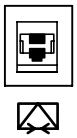
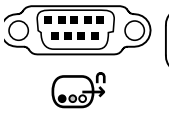
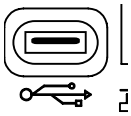
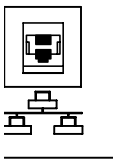


Figure 1-2: The External I/O Panel

Socket	Signal type	Device type	Note
Audio Out 	Audio	VCR Audio amplifier	Line level 1Vp-p R = Right L = Left
Trig Out	Digital synchronization signal	For future use	0 to 3V digital trig pulse corresponding to ECG

Socket	Signal type	Device type	Note
Footswitch 		3 pedals footswitch	
Serial port RS-232 	RS-232	For future use	
Remote 	Remote control of external peripherals	For future use	
Modem 	Analog phone line	Connection to GE OnLine Center or regional hubs for access to InSite remote diagnostic and iLinq assistance tool	
Composite Video Out	Composite NTSC/PAL video	VCR or video monitor	Signal level 1Vp-p
Black & White Video Out	Black and white video	B&W printer	Signal level 1Vp-p

Socket	Signal type	Device type	Note
S Video Out	NTSC/PAL S-Video	VCR or video monitor	Signal level 1Vp-p
SVGA Out 	RGB high resolution video	Computer monitor	
USB 	Universal serial bus	Printer	
Ethernet 	10/100 Base-TX Ethernet IEEE 8023	Network device	

Switching On/Off

To switch on the unit:

1. Switch on the circuit breaker on the rear of the unit (see Figure 1-4).
2. Press ⊖ (on/off button) on the top left of the control panel (see Figure 1-4).
   After initialization the default scanning screen (2D mode) is displayed, the active probe being the one connected to the left most connector socket.

Switching off the unit

When the Vivid 7/Vivid 7 PRO is switched off, the system performs an automatic shutdown sequence. The unit can be switched off into two states.

- **Standby mode**: most of the system is powered down, but a certain portion of the unit remains energized. The standby mode allows a shorter reboot time when the system is used on a daily basis or moved from one place to another.
- **Full shutdown**: the entire system is shut down. It is recommended to perform a full shutdown at least once a week.

Full shutdown

After switching off the system, wait at least ten seconds before turning it on again.

1. Press ⊖ (on/off button) on the top left of the control panel. The *Exit dialogue window* is displayed.

Figure 1-3: The Exit dialogue window

In case of total lock-up of the system, hold the on/off button down a few seconds to turn the system off.

2. Select **Shutdown**.
   The shutdown process takes a few seconds and is completed when the control panel illumination is turned off.

To switch off before moving the unit, follow the additional steps below:

1. Set the circuit breaker to **OFF**.
2. Remove the plug from the mains power socket.
3. Secure the unit power cable around the cable storage hooks on the rear of the unit.

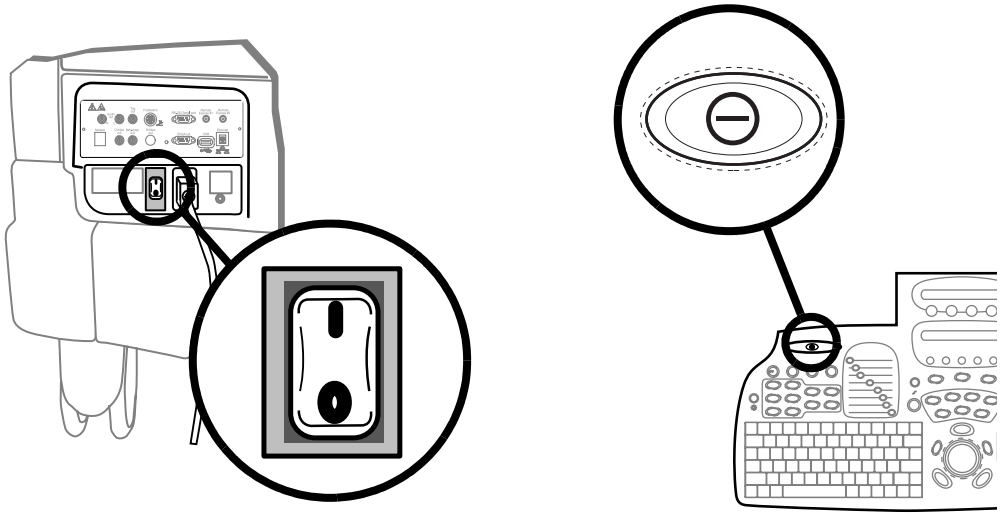


Figure 1-4: The Circuit breaker and On/Off button

Standby mode

1. Press ⊖ (on/off button) on the top left of the control panel.
   The *Exit dialogue window* is displayed (Figure 1-3).
2. Select **Standby**.
   The system enters in standby mode.

If the unit is to be moved while in standby, follow the additional steps below:

1. Set the circuit breaker to **OFF**.
2. Remove the plug from the mains power socket.

At the new location:

1. Secure the power plug in the wall outlet.
2. Switch on the circuit breaker on the rear of the unit (Figure 1-4).
3. Press ⏻ (on/off button) (Figure 1-4).

When turning on a system in standby it takes a few seconds before it responds. Do not push the on/off button again during this period (A second push will initiate a full shutdown).

If the power cable is removed from the wall outlet the system will remain in Standby mode for approximately 15 min using an internal battery. If the system is unplugged for a longer time period a full shutdown is automatically performed.

The system can be used regardless of the battery level. The battery is automatically charged when the system is plugged to the wall outlet and the circuit breaker is switched on. It takes about 10 hours to charge a flat battery.

If the system is left in the OFF condition (Circuit breaker in the OFF position and system unplugged from the wall out let) for an extended period of time (3 to 5 days or more), the system may not boot up or may beep when turned ON. Should this occur, the system needs to recharge the UPS batteries. This could take 15 minutes to as long as 10 hours, depending on the battery age, system input voltage and system temperature.

To eliminate draining the UPS batteries, the system should remain plugged into the wall outlet with the circuit breaker in the ON position.

Moving and transporting the unit

Wheels

The wheels of the unit are controlled by the pedals situated between the front wheels of the unit (see Figure 1-5).

Examine the wheels frequently for defects to avoid breaking or jamming.

Wheel	Characteristics
Front	Swivel, swivel lock and full lock
Rear	Swivel, but do not lock

1. **Swivel lock pedal (Free position)**
2. **Full lock pedal (Free position)**
3. **Front wheel**

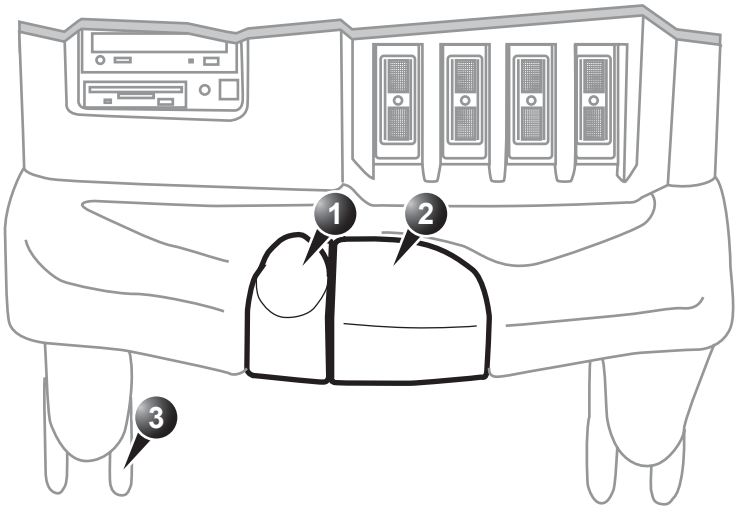
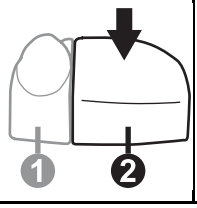


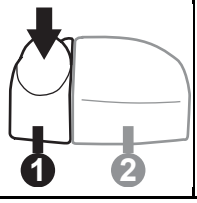
Figure 1-5: The Vivid 7/Vivid 7 PRO ultrasound unit pedals

Wheel operation

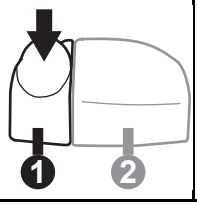
To engage the pedal in full lock

Pedal	Action
	Press on pedal no. 2

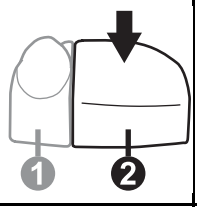
To release the brake

Pedal	Action
	Press on pedal no.1

To engage swivel lock

Pedal	Action
	Press on pedal no.1

To release swivel lock

Pedal	Action
	Press on pedal no. 2

Moving the unit

To prepare the unit to be moved

1. If not locked, push the keyboard console to its park position.
2. Turn the system off, including the circuit breaker (see page 18), and remove the plug from the wall.
3. Disconnect all cables linking the unit to any off-board peripheral devices and network.

Note the marks on each cable to reconnect them later.

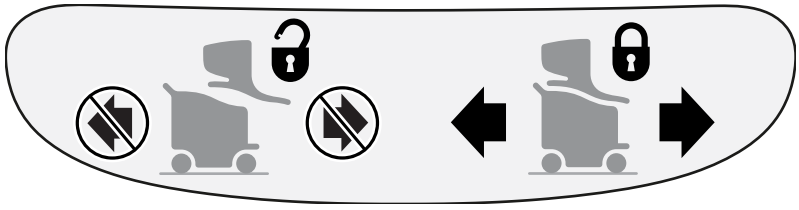
4. Secure the unit's power cable.
5. Place all probes in the probe holder. Ensure that the probe cables do not protrude from the unit or interfere with the wheels.

The park port may also be used for a probe connection although it is not active.

6. Ensure that no loose items are left on the unit
7. Unlock the brake (see page 22).

To ensure safety while moving the unit

1. Ensure that the keyboard console is in locked position.



WARNING

Do not move the unit if the keyboard console is in free position.

Ensure that the hands of the patient are away from the console arm when moving the keyboard console.

2. Proceed cautiously when crossing door or elevator thresholds. Grasp the front handle grips or the back handle

bar and push or pull. Do not attempt to move the unit using cables or probe connectors. Take extra care while moving the unit on inclines.

3. Ensure that the unit does not strike the walls or door frames.
4. Ensure the pathway is clear.
5. Move the unit slowly and carefully.

CAUTION

Avoid ramps that are steeper than 10 degrees.

6. Use two or more persons to move the unit over long distances or on inclines.

Transporting the unit

Take extra care when transporting the unit by vehicle. In addition to the moving precautions listed on page 23, follow the procedure described below.

1. If not locked, push the keyboard console to its park position.

WARNING

Do not move/lift the unit if the keyboard console is in free position.

2. Disconnect all probes and secure them in their boxes.
3. Ensure that the transporting vehicle is appropriate for the unit's weight. The recommended load capacity is a minimum of 190 kg (419 lbs).
4. Park the vehicle on a level surface for loading and unloading.
5. Secure the unit while it is on the lift, to prevent rolling. Do not attempt to hold it in place by hand. Cushion the unit and strap the lower part so that it does not break loose.
6. Ensure that the unit is secured inside the vehicle. Secure it with straps to prevent movement while in transit.
7. Drive cautiously to prevent vibration damage.

Reinstalling at a new location

1. When the unit is in place at a new location, lock the wheel

brakes (see page 22).

2. Follow the installation procedure described on page 12.

Unit acclimation time

Following transport the unit may be very cold or hot. Allow the unit to acclimate before being switched on. Acclimation will take one hour for each 2.5 ºC increment when the unit's temperature is below 10 ºC or above 40 ºC.

ºC	0	2.5	5	7.5	10	35	40	42.5
ºF	32	36.5	41	45.5	50	95	104	108.5
Hours	4	3	2	1	0	0	2	3
ºC	45	47.5	50	52.5	55	57.5	60	
ºF	113	117.5	122	126.5	131	135.5	140	
Hours	4	5	6	7	8	9	10	

System description

System overview

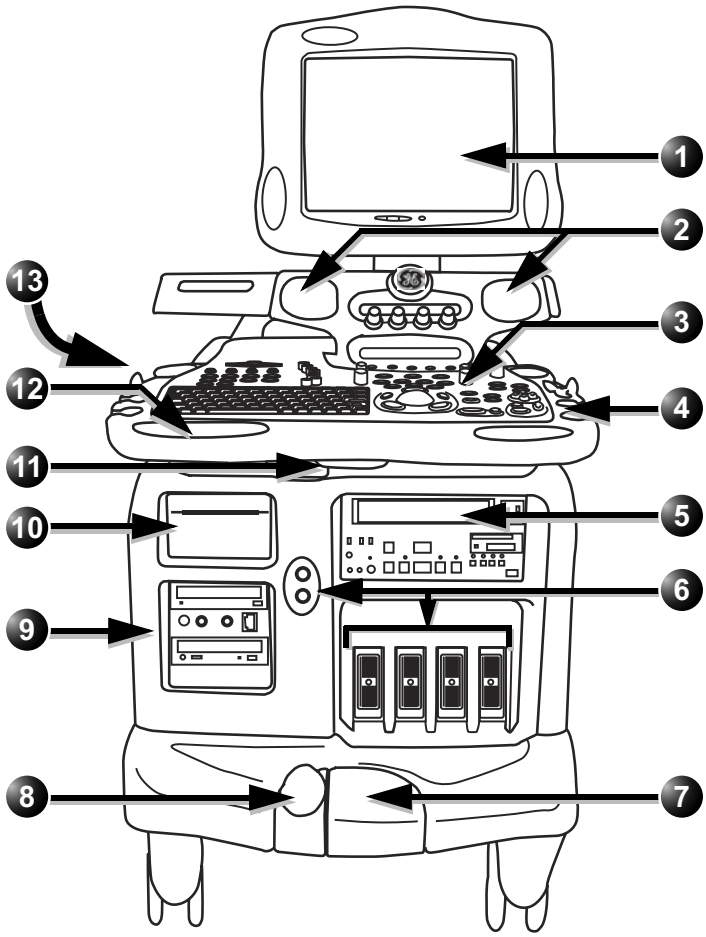
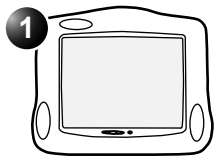
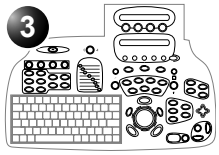
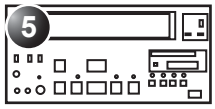
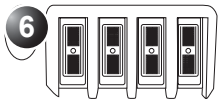
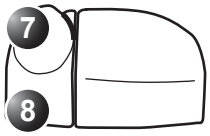
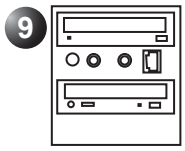
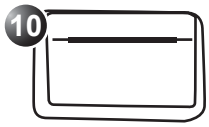


Figure 1-6: the Vivid 7/Vivid 7 PRO ultrasound system

	Legend	
		**Display Monitor:** Swivels to the left and right, tilts up and down.
		Speakers
		**Control panel:** Contains all the buttons and the alphanumeric keyboard used to operate the system. See page 29 for further details.
		Probe and gel holders: Situated on either side of the Control panel.
		**VCR**
		**Probe ports:** Three active and one park phased array probe ports, and two pencil probe ports.
		**Foot brakes:** Control swivel and brake of the wheels. See page 22 for further details.

	Legend	
CD-RW is not supported, only CD-R (recordable).		**Portable disks:** • Magneto optical disk • CD-ROM **Patient I/O**
		**Black & white video printer**
		Console swivel operating handle: Situated in the middle beneath the front handles. • Vivid 7: swivel and in/out displacement • Vivid 7 PRO: limited swivel only
		Console lifting operating handle: Situated in the left front handle.
		Color video printer

Control panel

The following pictures illustrate the layout of the Vivid 7/ Vivid 7 PRO control panel. The buttons and controls are grouped together for ease of use. A detailed description of the buttons is provided on the following pages.

1. **TGC sliders**
2. **Loudspeaker volume control**
3. **On/Off button**
4. **F1-F4 keys: (Not in use)**
5. **Navigation keys: Archiving & Reporting buttons Pre-examination buttons Video playback**
6. **Function keys: System Configuration Annotation On-line manual**
7. **Alphanumeric keyboard**

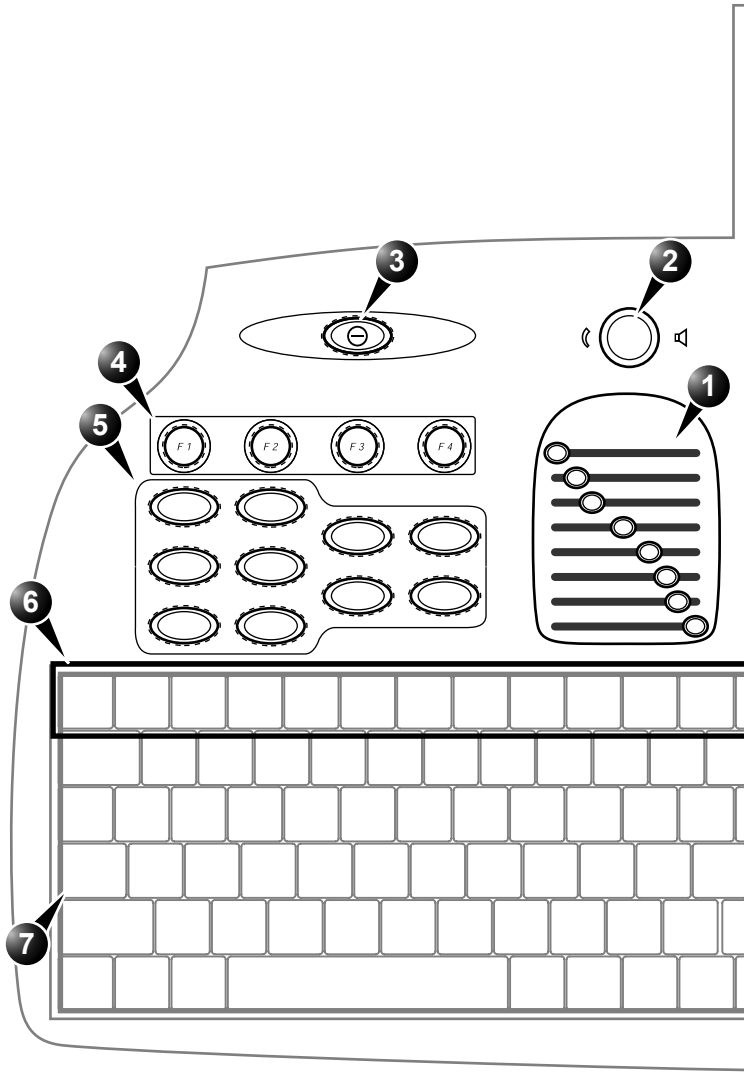
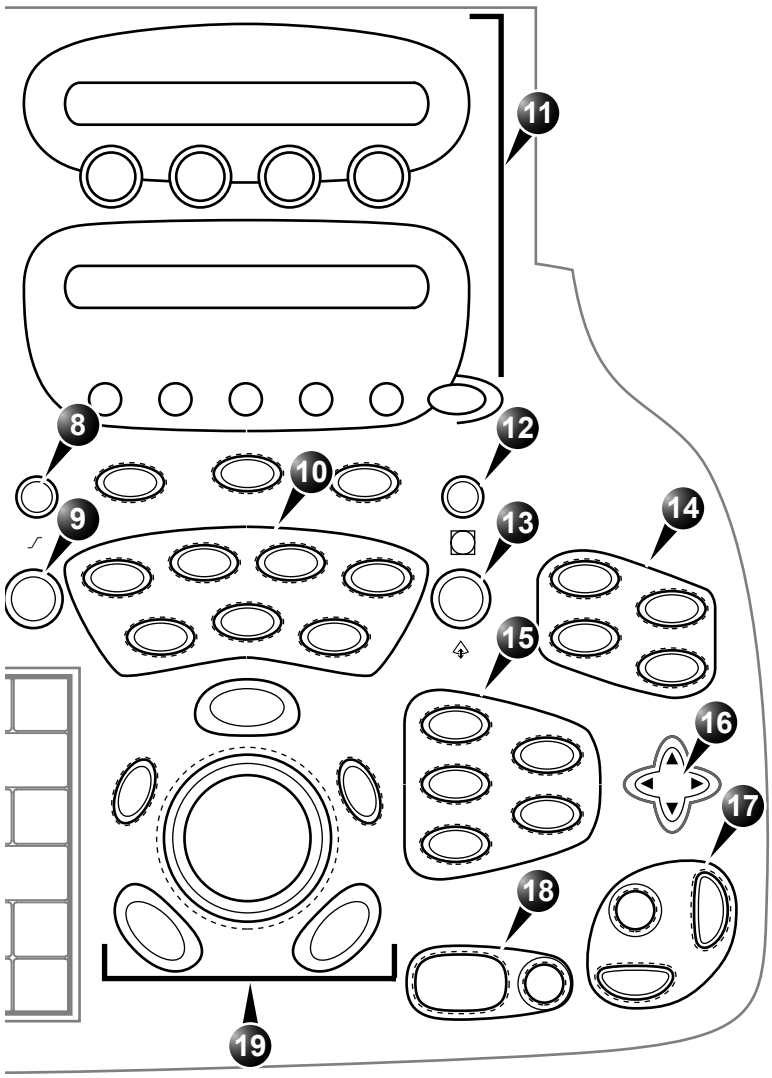


Figure 1-7: The control panel (left side).



8. **Active mode gain**
9. **2D gain**
10. **Scan mode selection keys**
11. **Assignable keys**
12. **Zoom control**
13. **Depth control**
14. **Display format keys**
15. **Measurement, Image store and menu keys**
16. **Soft menu rocker**
17. **VCR controls and print keys**
18. **Freeze keys**
19. **Trackball operation**

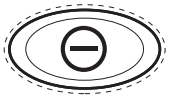
Figure 1-8: The control panel (right side).

Key illumination

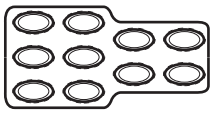
The keys on the control panel are illuminated according to their availability:

- **Illumination in green**: the key function is currently active.
- **Illumination in yellow**: the key function is available (but not active) in the current state of the scanner.
- **No illumination**: The key is not available in the current state of the scanner.

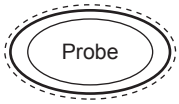
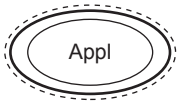
Power On/Off key

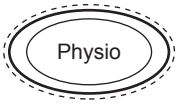
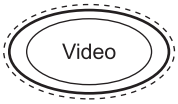
Key	Description
	Turns the unit on and off.

Navigation keys

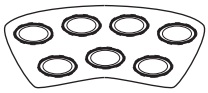


The following buttons on the top left of the control panel are used for navigation between different screen or packages on the scanner. They are related to either pre or post-examination operations. Each of these operations are described in more detail in the following chapters.

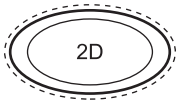
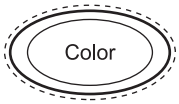
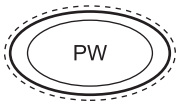
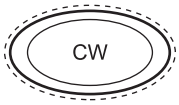
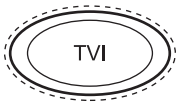
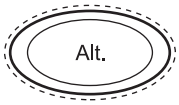
Key	Description
	Displays the *Search/Create patient window*. Enables the creation of a new patient record.
	Displays the Select Probe and Application dialog box that enables the users to select the desired probe and application preset for the current examination. For information about selecting probes, refer to page 53 and page 366.
	Displays the Application dialog box that enables the users to select the appropriate application preset for the current examination.

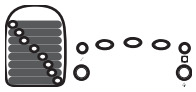
Key	Description
	Gives access to controls for physiological traces. The controls appear on the assignable keys.
	Displays the examination report.
	Brings the scanner into the Image review mode, that enables the user to select images from the clipboard for analysis, activate the image browser or enter the *Image Review screen* where bigger previews of the images are shown for image selection. Refer to page 293 for details on the review of images.
	Displays the *Search/Create patient window* if no patient record is currently selected. Enables the user to search a patient record in a patient archive (see page 279). If a patient record is selected, displays the *Patient information screen*.
	Displays the *Measurement worksheet* where the user may edit or delete measurements, change averaging etc. Refer to page 230 for details on how to operate the worksheet.
	Brings scanner into video playback mode that enables the user to look at video tape recordings. For further information about video playback control refer to page 384.

Scan Mode Selection keys



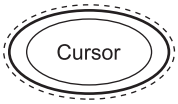
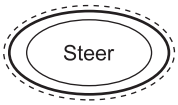
The following keys are used to select the required scan mode, and to select additional tools that enhance the application's capabilities. Refer to page 89 for detailed information about scanning.

	Key	Description
		Displays the 2D live acquisition mode that is the default scanning screen for the unit. For further information on 2D scanning, refer to page 92.
M-Mode can be added from a 2D scan also in replay.		Displays the M-Mode examination screen and enables M-Mode functions. Used for viewing motion patterns. For further information, refer to page 98.
		Displays the examination screen in Color Flow Mapping mode. Used to display color-coded blood flow information. For further information, refer to page 104.
In replay mode with TVI the velocity trace mode will be toggled on by the PW key.		Displays the examination screen in Pulsed Wave Doppler mode. Used for displaying the Doppler spectrum of blood flow at a selected part of the anatomy. For further information, refer to page 112.
CW mode is not available on all scanning probes.		Displays the examination screen in Continuous Wave Doppler mode. Allows examination of blood flow data all along the Doppler CW cursor. For further information, refer to page 112.
		Displays the tissue velocity overlay on 2D and M-Mode scans. If TVI is on, the Doppler modes (PW/CW) will also be optimized for tissue velocity. For further information, refer to page 119.
		Depending on the options installed on the scanner, this key will bring up the menu for selection of additional scanning modes.

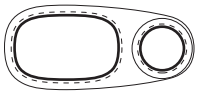


Basic Mode Parameter Adjustment Controls

The following controls are used to modify and adjust the unit's display to best suit the user's requirements, such as color, gain, zoom and image depth, according to the mode being operated by the user.

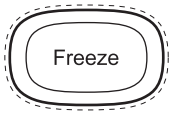
Controls	Description
2D Gain	Controls the total gain of the gray scale images in 2D Mode.
Active mode Gain	Controls the total gain of other activated modes, such as, M-Mode, Color, PW, or CW Doppler mode.
TGC	Sliding keys that compensate for depth-related attenuation in an image. The upper slider corresponds to the smallest depth.
Depth	Controls the displayed depth of tissue scan. Has no effect in replay.
	Toggles the cursor display on/off in 2D scanning mode.
	Changes the angle of the cursor on linear probes. The steering angles are fixed for each linear probe. This key has no effect with sector imaging probes.

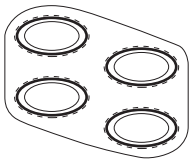
Controls	Description
	Toggles the high resolution (HR) zoom on/off. The key has no effect in replay. The HR zoom concentrates the image processing to a user selectable portion of the image, resulting in an improved image quality and a higher frame rate in the chosen ROI
Display Zoom	Controls image magnification. Rotate clockwise to activate zoom mode and increase zoom factor. Rotate counterclockwise to decrease and turn off zoom. Zoom is available in both live and replay.



Freeze keys

The freeze keys are used to freeze images and cine loops in all modes for on-line analysis and storage for future use.

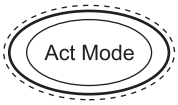
Key	Description
	Stops or restarts all data acquisition. When scan is frozen, the Trackball can be used to scroll through the cine loop.
	Activates or freezes 2D mode. In simultaneous mode, pressing **2D FREEZE** will activate or deactivate the 2D image, leaving the other mode display unchanged. In freeze mode, stops/starts the cineloop.



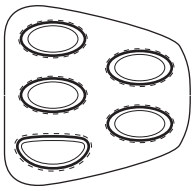
Display format keys

The following keys provide different view formats to best suit the user's requirements.

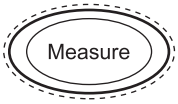
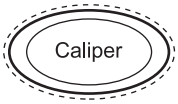
Key	Description
	Toggles the display priority of 2D-Mode or Doppler/M-Mode and top/bottom or side by side display when working in combined mode. This key is only active in Doppler or M-Mode.

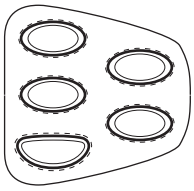
Key	Description
	Enables multiple image display windows in which two or four images can be viewed simultaneously. When reducing the number of images, the active window will always been kept.
	In combined mode, switches between the mode specific assignable controls of the currently used modes.
	Toggles the active window in multiple imaging mode. The active window is indicated by a highlighted frame. All imaging controls are normally applied only to the active window.

Measurement controls

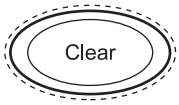
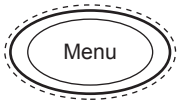


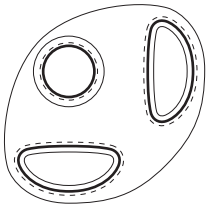
The following keys are used to take measurements and perform calculations.

Key	Description
	Activates the Measurement & Analysis (M&A) calculation program. This program is context sensitive and will display relevant measurements to the current mode and application. See page 209 for further details on M&A.
	Activates measurement tools (unassigned measurement). See page 209 for further details on M&A.

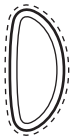


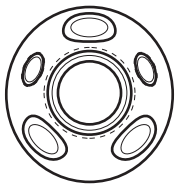
Clear, Menu, and Image Store keys

Key	Description
	Used for navigation between menus and screens. **CLEAR** brings the display back to the previous state.
	Activates menu with additional options and controls not available from the assignable keys.
	Stores the currently active imaging window to disk. The stored information depends of the configuration of the current application. Stored images are shown on the clipboard.



VCR Control and Print key

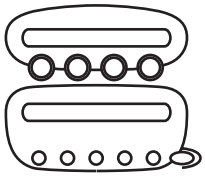
Key	Description
Rec/Pause 	Toggles the VCR to Record or Pause. For further information about using VCR, Refer to page 381.
	Prints the current imaging screen content to a selected (configurable) printer. For more information about printing. Refer to page 381. The **PRINT** key can also be configured for alternative storing of images (Refer to page 432.).
	Prints the current imaging screen content to a printer assigned to a second port (configurable). For more information about printing, Refer to page 388. The **ALT** key can also be configured for alternative storing of images (Refer to page 432.).



Trackball operation

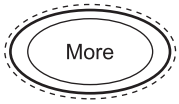
The Trackball area consists of the trackball and five surrounding keys. Three of these have the very same function (the select function) for ergonomic reasons.

Key	Description
Trackball	Used for navigation and together with the surrounding keys, to move, select or activate objects on the screen.
Trackball key	Controls the trackball assignments between the mode-specific options. By pressing **TRACKBALL**, the trackball function will cycle through the possible assignments, which are indicated in the lower right corner of the screen.
Select	Activates selections made by using the trackball. The select function works in much the same way as the left button on a PC mouse. The key is duplicated for ergonomic reasons.
Update Menu	In live mode, toggles between 2D imaging and live time-motion imaging (Doppler/M-Mode). In freeze, displays the function-specific menu (same function as **MENU**, on page 37).



Assignable keys and rotary knobs

The functions of the assignable keys vary according to the mode and/or module in which the user is working.

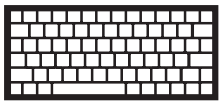
Key	Description
Assignable rotary knobs	Four rotary knobs, whose functions vary according to the scan mode and position that is currently active. The assigned functions are indicated above the rotary on the LCD display. The mode-specific functions for these rotary knobs are described in Chapter 3, ’Scanning Modes’ on page 89.
Assignable Buttons	Five buttons, whose functions vary according to the scan mode and position that is currently active. The assigned functions are indicated above the button on the LCD display. The mode-specific functions for these buttons are described in Chapter 3, ’Scanning Modes’ on page 89.
	Gives access to additional controls from the assignable buttons.

The soft menu rocker

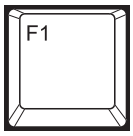
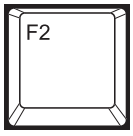
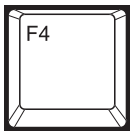
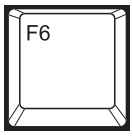
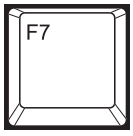
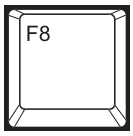
Key	Description
Soft Menu Rocker	A 4-way rocker used to access mode-specific menus, select a menu option and adjust option-related values. • The vertical arrows are used to select the menu options. • The horizontal arrows are used to adjust the values. The mode-specific menus are described in Chapter 3, ’Scanning Modes’ on page 89.

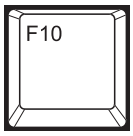
The F1 to F4 keys

Key	Description
Function 1–4	These keys are not currently enabled (future use).

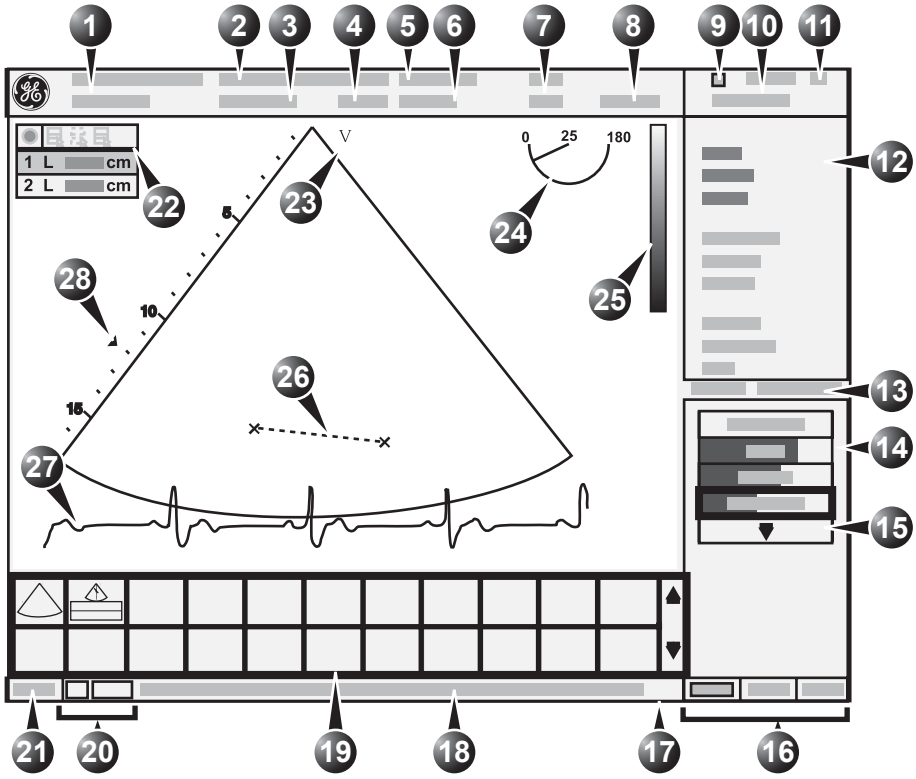


The alphanumeric keyboard

Key	Description
	Displays the on-line version of the user manual.
	Displays the configuration dialog box, allowing user configuration of various settings on the scanner. Some settings are configured for each application, press **APPL.** to access to application-specific settings.
	Displays the DICOM spooler window. The DICOM spooler is used for checking the current job's status when a job is saved or when the total spooler status on the right of the Archive windows displays an error.
	Displays the available body marks for the current application.
	Erases all previously typed annotations (and body marks.
	Activates a cursor for selection of a single annotation to be deleted from an image.
	Displays an arrow that can be used to point at a specific structure in the image.

Key	Description
	Enables text annotation to be inserted on the image. The annotations can be typed or selected from a (configurable) menu.

The Scanning screen



1. Current patient data
2. Institution
3. Date & time
4. Operator ID
5. Probe
6. Application
7. Mechanical & Thermal Index
8. VCR counter (replay)
9. VCR status
10. Date & time
11. Heart rate
12. Parameter window
13. Frame counter and timer
14. Soft menu window
15. Pull-down soft menu
16. Trackball assignment
17. Status bar
18. Prompt/Status information
19. Clipboard
20. Service and iLinq (future use)
21. Caps on/off
22. Measurement result table (measurement mode)
23. Probe orientation marker
24. Scanplane indicator (for TE probe)
25. Greyscale/Color bar
26. Measurement
27. Physiological traces (ECG, Phono, Resp)
28. Focal zone and depth scale

Figure 1-9: The scanning screen

The scanning screen is divided in several areas as follows:

The title bar

From the left:

The patient information displayed on the Title bar is configurable (see page 437).

Patient Information

Displays the information that uniquely identifies the patient, such as patient name, identification number and birth date. This information is entered in the *New patient window*, as described on page 49.

Institution name

The institution name is entered from the configuration package. See page 443 for more detailed information.

Operator ID

Identification code of the operator. See page 449 for creating operator ID's.

Date and time

Displays the current date and time or for a retrieved image, the date and time at which it was stored.

Probe and Application

Displays the currently selected probe and application or for retrieved image the probe and application that were used. See page 53 and page 366 for further information on how to select probe and application.

Live scanning related information

Displays, if available, the current values for

- Mechanical Index (MI), for the current active image
- Thermal Index (TI), for the current active image
- probe temperature (for TE probe)
- Heart rate (HR)

Heart rate values greater than 250 BPM may not be accurately displayed.

VCR counter and status

Displays the VCR counter as it changes in real time, and a status icon, which indicates the current operating status of the VCR.

Archive Information

Displays the currently selected patient and image archives.

Parameters window

Displays scan mode or application specific parameters. In scanning mode the parameters for the active mode are highlighted. This window also displays zoom information, stress template and image groups in image browser.

Soft menu window

Displays the mode specific controls operated from the 4-way rocker on the control panel. The mode-specific menus are described in Chapter 3, ’Scanning Modes’ on page 89. For operating procedure of the 4-way rocker see page 58.

Clipboard

Displays the thumbnail images representing the acquired data during the current examination.

The status bar

Consists of three information fields as follows:

Caps on/off indicator

Located on the left side of the status bar, the word **CAPS** is highlighted when the caps lock function is on. The caps function is activated by pressing **CAPS LOCK** key on the alphanumeric keyboard.

Prompt/status field

Displays system messages or prompts the user for actions.

Trackball assignments fields

Displays the available assignments of the trackball. The current assignment is highlighted.

The acquisition window

Displays the ultrasound image with relevant indicators such as depth, focus, probe orientation marker, physiological traces...etc.

Footswitch operation

The footswitch is used to free the hands of common key operations, such as select keys, video recording, etc. The three switches have different function assignments depending on the current application (see page 400).

Connecting the footswitch

1. Connect the footswitch to the input marked on the External I/O panel (see Figure 1-10).

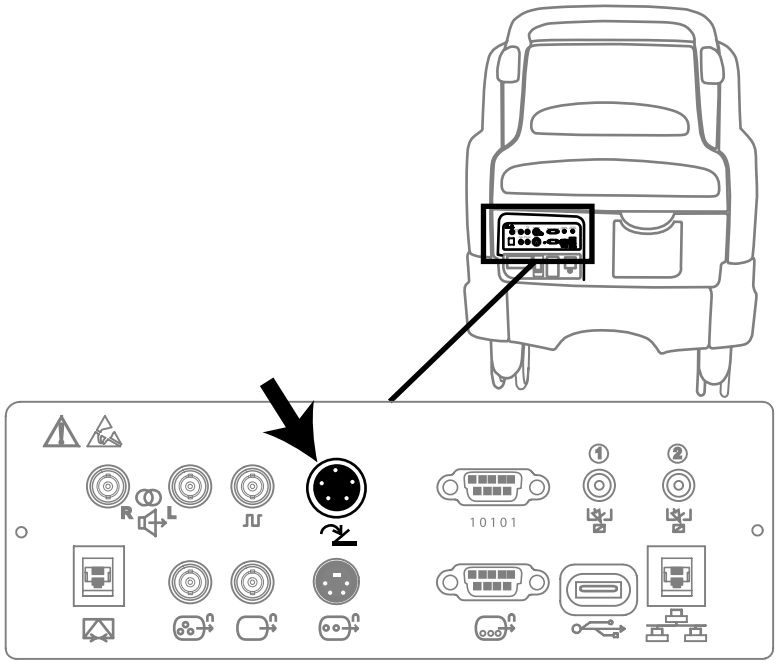


Figure 1-10: The Footswitch connector on the External I/O Panel

Connecting and disconnecting probes

The connector panel situated in the front of the unit has three imaging probe ports, one parking port (inactive) and one pencil probe port.

To connect probes:

CAUTION

Handle the probes gently while connecting and disconnecting.

1. Hold the probe connector vertically with the cable pointing upward.

WARNING

Do NOT touch the patient and any of the connectors on the ultrasound unit simultaneously, including ultrasound probe connectors.

Probes can be connected or changed any time while the unit is on.

2. Turn the connector locking handle to the horizontal position.
3. Align the connector with the probe port and carefully push into place.
4. Rotate the locking handle to the full vertical position to lock in place.

To disconnect probes:

1. Rotate the lock handle counter-clockwise to the horizontal position to unlock the connector.
2. Remove the connector.

Adjusting the display monitor

The display monitor's contrast and brightness controls may need periodic adjustment due to changes in ambient light. They are adjusted from the three buttons on the front part of the display monitor.

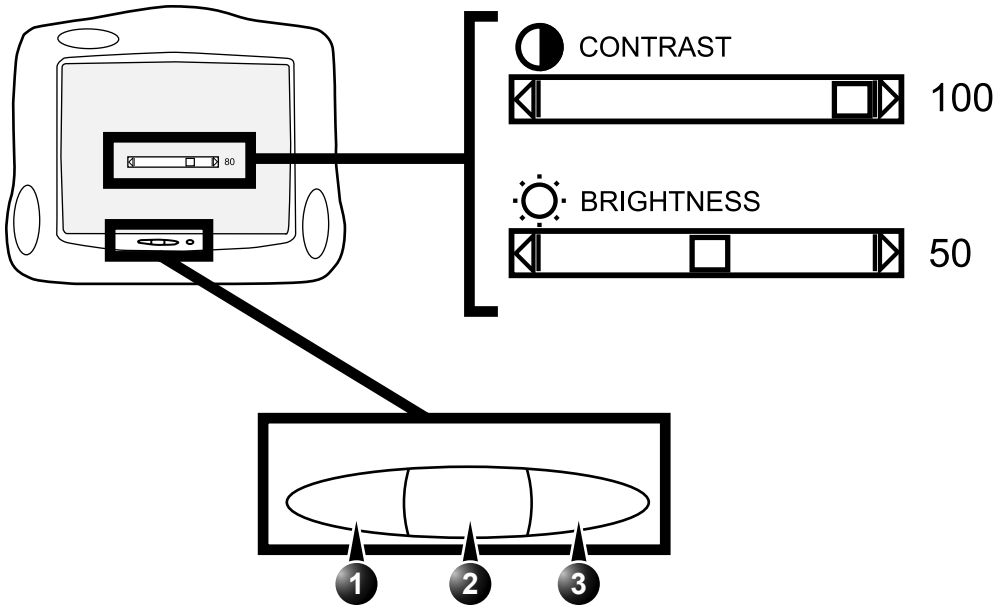
To adjust the contrast of the display monitor

1. Press the **Center button** on the display monitor once (see Figure 1-11).
2. Press the **Right button** to increase contrast.
   Press the **Left button** to decrease contrast.

The amount of contrast is shown on a slider on the screen (see Figure 1-11).

To adjust the brightness of the display monitor

1. Press the **Center button** on the display monitor twice (see Figure 1-11).
2. Press the **Right button** to increase brightness.
   Press the **Left button** to decrease brightness.
   The amount of brightness is shown on a slider on the screen (see Figure 1-11).



1. Decrease
2. Contrast (press once), Brightness (press twice)
3. Increase

Figure 1-11: Contrast and brightness adjustment

Starting an examination

Beginning an exam consists of three steps:

- Creating a new patient record or starting a new examination from an existing patient record (see below)
- Selecting Probe and Application (see page 53)
- Start scanning (see page 53)

Creating a new Patient record or starting an examination from an existing patient record

Connectivity on the Vivid 7/Vivid 7 PRO ultrasound unit

Refer to page 423 for further information on connectivity setup.

The connectivity on the Vivid 7/Vivid 7 PRO Ultrasound unit is based on the Dataflow concept. A Dataflow is a set of pre-configured services (e.g. DICOM services like storage, worklist, verify...etc. or other service types like video print, standard print or messaging). When starting an examination, the user selects a pre-configured Dataflow that will automatically customize the ultrasound unit to work according to the services associated to the Dataflow.

Starting an examination

1. Press **NEW EXAM**.
   If the unit is password protected a *Log In window* will appear asking for operator ID, and password.

To create an operator ID, see page 449.

1. **Data stored only for the duration of the current examination**
2. **Select the operator**

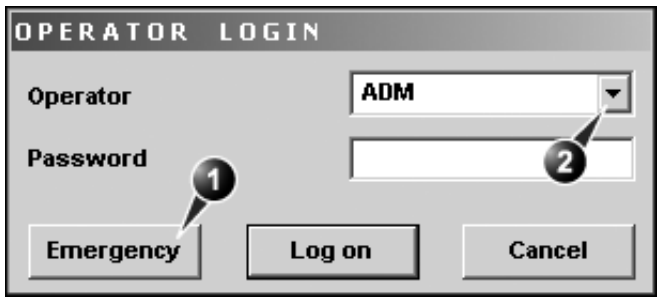


Figure 1-12: The Operator login window

2. Press **Log on** when completed.
   The *Search/Create Patient window* is displayed (see Figure 1-13).
3. Type the patient **Last Name**, and/or **ID**.

△
CAUTION

Do NOT use '\' or '^' in patient information fields, as these characters might cause problems with some DICOM devices.

The unit can be configured to automatically generate a patient ID (see page 437).

When default configured, the system automatically searches to see if the patient is already in the database. The result of this search is displayed in the *Patient List field.*

If the Patient name is on the patient record list:

*To restrain the search to special category of patient record, press **More** and use the searching filters.*

1. Trackball to the actual patient and double-click the Trackball **SELECT** key (or press **SELECT** once and then **Select patient**).
   The unit is ready for scanning or the *Patient information window* is displayed (Figure 1-14) depending on system configuration (see page 437).

If the Patient name is not on the patient record list:

The automatic search tool displaying matching patient information in the Patient list can be turned off (see page 437).

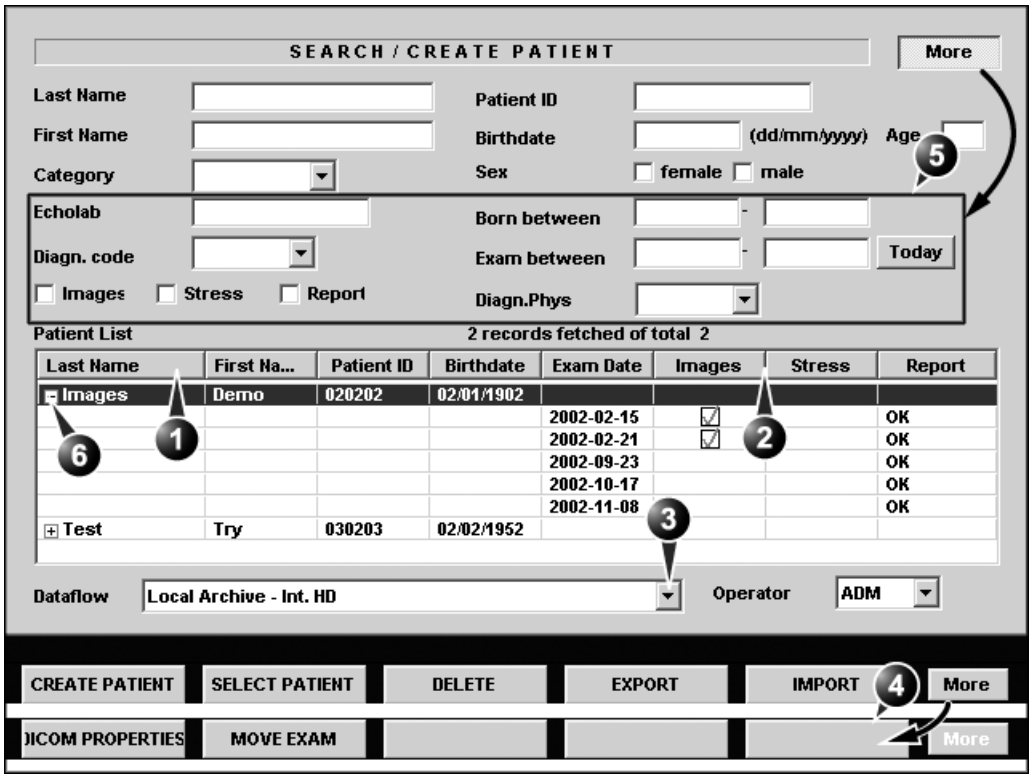
1. press **Create Patient**.
   The unit is ready for scanning or the *Patient information window* is displayed (Figure 1-14) depending on system configuration (see page 437).

If the unit is configured to display the *Patient information window*, follow the steps below:

1. Enter additional patient information if required.
   Select between **cardiac**, **obstetric**, **gynecology**... etc. to enter application specific patient info (Displayed when the button **More** is depressed, see Figure 1-14.).

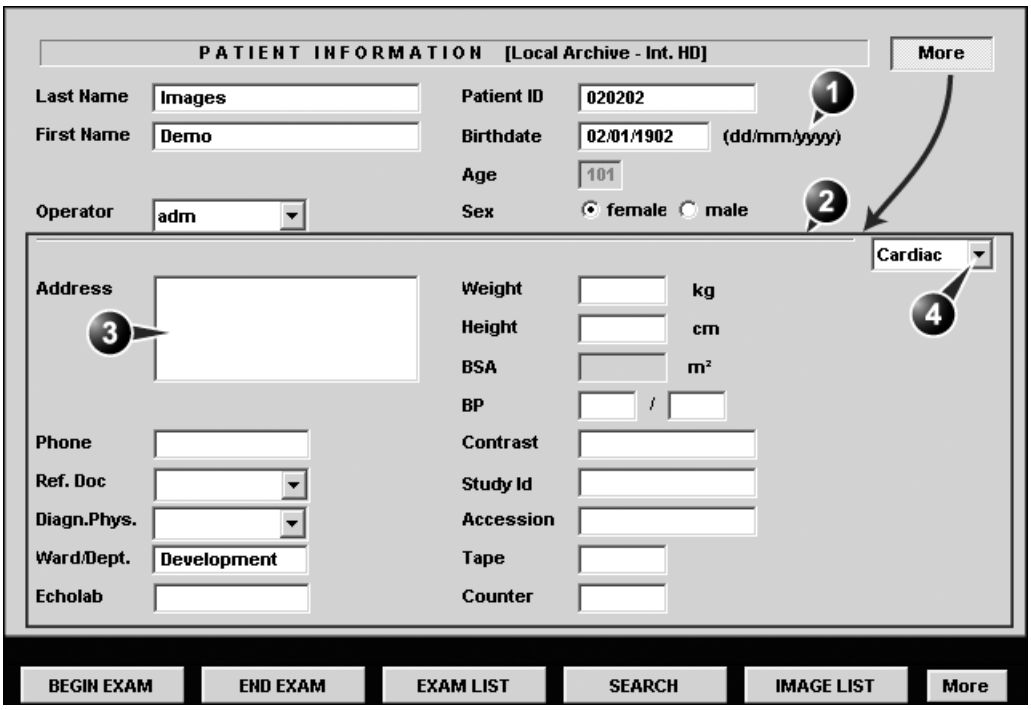
*Press **EXAM. LIST** to display the previous examinations and diagnosis information for the selected patient.Enter additional patient information if required.*

2. Press **Begin exam** or any active scanning key to start the examination.
   In the scanning screen, the patient information is displayed on the left side of the *Title bar* (see Figure 1-15).



1. **Press one of the headings to sort the list accordingly.**
2. **Select the column heading border and drag to adjust column width.**
3. **Select new archive and other pre-defined services.**
4. **Extended menu**
5. **The system can be configured to display the Advanced search tool as default (see page 437).**
6. **Expended Patient record displaying belonging examinations**

Figure 1-13: The Search/Create Patient window



1. **The date format is configurable (see page 443).**
2. **The window can be configured to display the expanded patient info as default (see page 437).**
3. **The Address field is configurable (see page 437).**
4. **Select patient information category.**

Figure 1-14: The Patient Information window

1. **The patient information on the scanning screen is configurable (see page 397).**

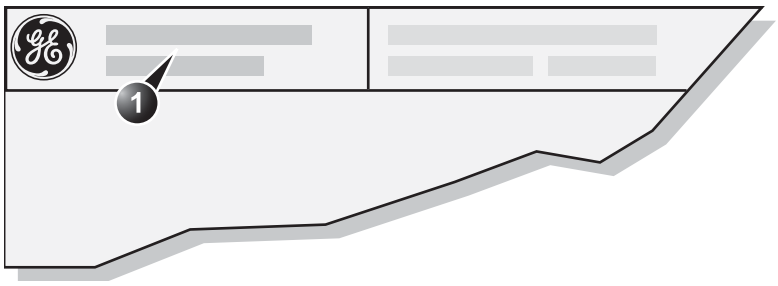


Figure 1-15: The Patient information on the scanning screen

Selecting a Probe and an Application

The combination Probe-Application may be user-defined. See page 400 for information on probe/application configuration.

Probes and their related applications are selected from the Probes and applications pop-up menus as described below. Only probes currently connected are displayed in the pop-up menu. Only applications appropriate for the type of probe selected are shown.

To select a probe and an application

1. Press **PROBE** on the control panel.
   A list of the connected probes is displayed.
2. Trackball to the desired probe.
3. Press **SELECT**.
   An *Application menu* for the selected probe is displayed.
4. Trackball to the desired application.
5. Press **SELECT** to launch the application.

To change application without changing the current probe, press **APPL.** *on the control panel.*

To select a probe with the default application, press **SELECT** *twice on the actual probe.*

△
CAUTION

Make sure that the probe and application names displayed on the screen correspond to the actual probe and application selection.

Check that the correct TI category is displayed (see 'Thermal Index' on page 471). TIB must be displayed when a fetal application is selected.

Chapter 2
Basic scanning operations

This chapter describes basic operations related to scanning. Some operations described in this chapter are fully described in the respective chapters throughout the manual.

This chapter includes the following information:

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  - Using the Soft Menu Rocker 58
- **Trackball operation 59**
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  - The system menu 61
- **Cineloop operation 62**
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  - Cineloop controls 64
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Assignable keys and Soft Menu Rocker

1. **Active mode & status**
2. **Filling gauge**
3. **Selected control shows highlighted frame**
4. **Access to additional controls**

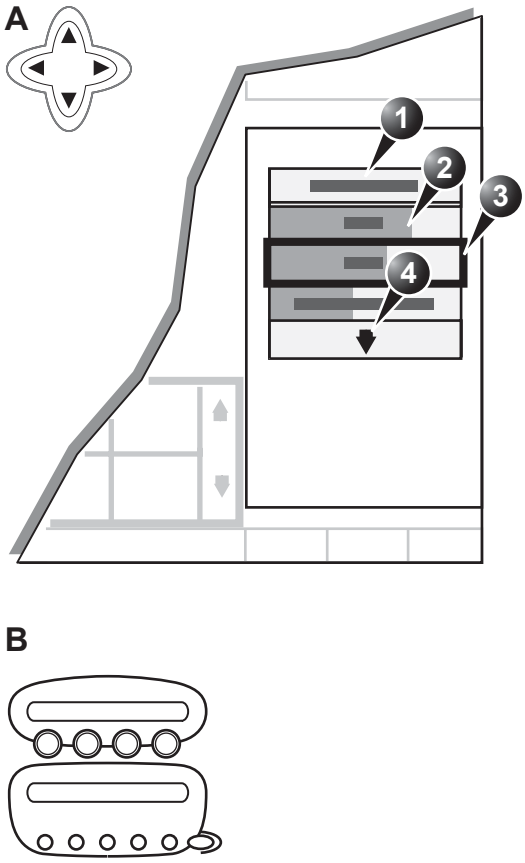


Figure 2-1: A: the 4-Way Rocker and Soft Menu. B: the assignable keys and rotary knobs on the control panel.

To toggle between modes in combined mode, press **ACT. MODE**.

The function of the assignable keys and the controls assigned to the soft menu vary according to the mode in which the system is running. A detailed description of each function is provided each scanning mode in the following imaging mode sections. In combined modes (i.e. combined Color flow and PW Doppler), one mode is active (live) while the other is frozen. In this case, the assignable keys and rotary knobs control the active mode. Switching the active mode will change the key and rotary assignments accordingly.

Using the Soft Menu Rocker

The **Soft menu Rocker** on the control panel enables the adjustment of controls mapped in the *Soft menu Window* (see Figure 2-1).

The first row of the soft menu indicates the active mode and its status (freeze/live). The following rows list the mode specific controls. The last row (marked with a ⬇) gives access to additional mode specific controls.

The relative setting of each control is indicated by a gauge bar filling the cell as the control value increases.

To select a control from the menu

1. Press the vertical arrows on the 4-way Rocker to navigate up or down through the menu.
   The frame of the selected row is highlighted.

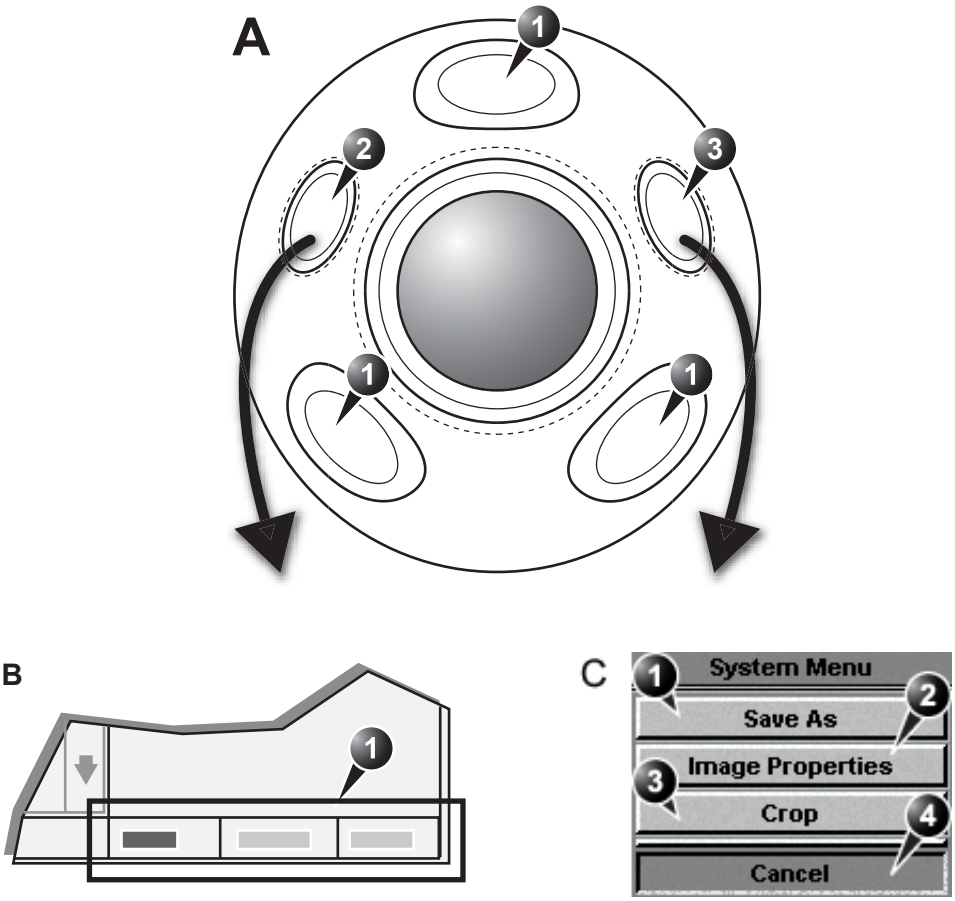
To adjust values

1. Press one of the horizontal arrows on the 4-way Rocker to adjust the setting of the selected control.
   - **Right arrow** increases control setting.
   - **Left arrow** decreases control setting.

Trackball operation

Different functions can be assigned to the trackball depending on the current active mode.The trackball area consists of:

- The **trackball**: used as a cursor control in acquisition mode, scrolling control in freeze mode and as a selecting tool (like a mouse cursor) in post-processing mode.
- **Three SELECT keys (identical)**: Perform the selected control or highlighted menu item.
- **The TRACKBALL key**: Toggles between the available trackball function assignments displayed in the *Status ba*r.
- **The UPDATE MENU key**: enables quick access to image related functions from a pop-up menu (see Figure 2-2).



A

1. **Select keys: perform the selected control or highlighted menu item**
2. **Trackball key: select trackball assignment (B) from the available functions displayed in the Status line.**
3. **Update Menu key: select the operation to perform from the pop-up System menu (C).**

B

1. **Trackball assignments: Mode specific trackball assignments (The selected assignment is highlighted.**

C

1. **Select file format and store image to a desired location.**
2. **Access to image and patient information**
3. **Enlarge the image display resulting in cropping of the edges**
4. **Exit System Menu**

   The contents in the *System menu* is context dependent.

Figure 2-2: The Trackball area

Trackball assignment

The trackball has a multi-mode function. The functions available from the trackball are mode dependent. The available trackball functions for the active mode are displayed on the right side of the *Status line* (Figure 2-2).

To change trackball assignment

1. Press **TRACKBALL** in the Trackball area until the desired function is selected highlighted.

The system menu

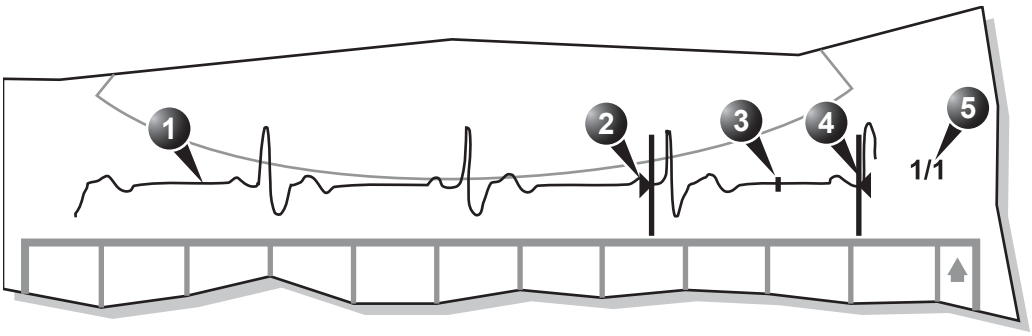
The system menu enables a quick access to image related functions (see Figure 2-2).

Cineloop operation

When no ECG is connected, a cine gauge is displayed indicating the current frame. in the cineloop.

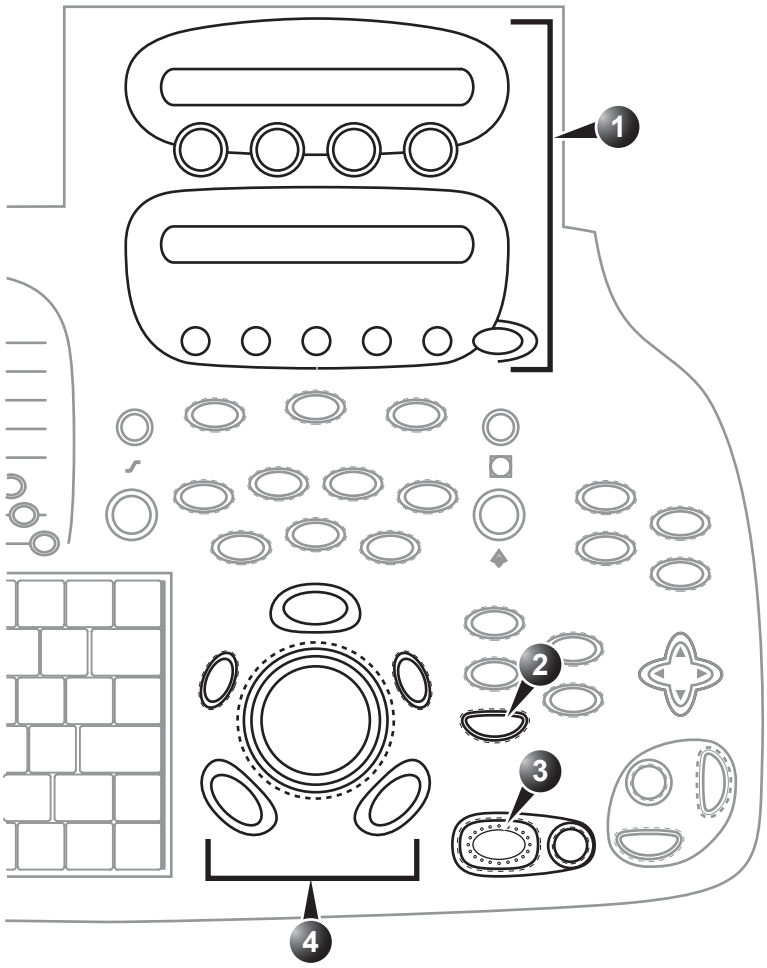
When the scan mode is frozen, the unit automatically displays cineloop boundary markers on either side of the last detected heart cycles. The cineloop boundaries can be adjusted using the cineloop assignable controls to cover one or more heart cycles.

Cineloop overview



1. **ECG**
2. **Left marker**
3. **Current frame**
4. **Right marker**
5. **Cine speed (replay)**

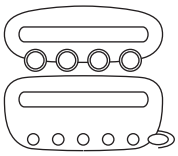
Figure 2-3: The cineloop controls display



1. **Assignable keys:**
   - **Left marker**
   - **Right marker**
   - **Cycle select**
   - **Number of cycles**
   - **First Cycle**
   - **Last Cycle**
   - **Sync**
   - **Cineloop**
   - **Select all**
2. **Image Store**
3. **Freeze: Start/stop cineloop**
4. **Trackball:**
   - **Scroll (in freeze)**
   - **Cine speed (in replay)**

Figure 2-4: The cineloop controls on the front panel

Cineloop controls



cineloop assignable controls

Left / Right Marker

Move the left and right markers to expand or trim the cineloop boundaries.

Cycle select

Selects the heart cycle to be played back.

Number of cycle

Controls the number of heart cycles to be included in the loop.

First cycle / Last cycle

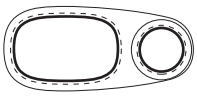
Selects the first or last heart cycle to be played back.

Sync

Phase synchronizes multiple cineloops.

Cineloop

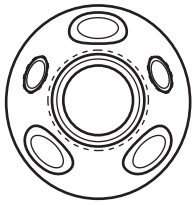
Starts cineloop acquisition.



Cineloop Freeze Control

2D Freeze

Toggles between replay and freeze modes.



Cineloop trackball controls

Scroll

When the scan mode is frozen, trackball to move the current marker and review the images

Cine speed

In cine replay mode, trackball to adjust the speed of the cineloop playback.

Select All

Select all heart cycles.

Using cineloop

Selection of a cineloop

1. Press **FREEZE**.
   The left and right markers on the ECG trace are displayed on either side of the last detected heart cycle.
2. Press the **CINELOOP** assignable.
   The selected heart beat is played back.
3. Press the **2D FREEZE** assignable to freeze the cineloop.
4. Use the **Trackball** to scroll through the acquisition and find the sequence of interest.
5. Rotate the assignable **CYCLE SELECT** to move from heart beat to heart beat to select the heart cycle of interest.
6. Rotate the assignable **NUM CYCLES** clockwise to increase the number of heart beats to be played back.
7. Rotate **LEFT MARKER** and **RIGHT MARKER** assignables to trim or expand the cineloop boundaries.

To jump directly to the first or to the last heart beat press the assignables **FIRST CYCLE** *or* **LAST CYCLE**.

Adjustment of cineloop playback

1. If in freeze mode, press the assignable **2D FREEZE** to start cineloop replay.
2. Use the **Trackball** to increase or decrease the speed of the cineloop playback.
   The speed factor is displayed on the right side of the ECG (see Figure 2-3).

To view a cineloop frame by frame

1. If not in freeze mode, press the assignable **2D FREEZE** to freeze the cineloop.
2. Use the **Trackball** to scroll through the cineloop frame by frame.
   Or
   Press the alphanumeric **ARROW** keys.

Synchronized playback of multiple cineloops

1. If in freeze mode, press the assignable **2D FREEZE** to start cineloop replay of the displayed cineloops.
2. Press the assignable **SYNC** to phase synchronize the loops.

Storing images and cineloops

Images stored on the clipboard during the scanning session are for immediate purposes. At the end of the examination, the data should be archived in the patient archiving system (refer to page 269).

Images and cine-loops can be stored at any time during the scanning session. A thumbnail of the stored image is displayed on the clipboard on the scanning screen. An icon will also be displayed in the *Image Browser* and *Image Selection screens*. Protocol based stored images will also be displayed in the protocol grid in the *Parameters window*.

The amount of data stored from 2D live is defined by the settings of the current application. The application setting controls the number of cycles included (or time span if ECG is not active), time span before R-wave...etc (refer to page 397 and page 400 for further information).

The amount of data stored in images from 2D replay is determined by the defined cineloop.

Images can be stored in either DICOM and GE Raw Data formats or DICOM format only, depending in the dataflow configuration (refer to page 424 for further information).

To store a single image

1. Press **FREEZE**.
2. Press **IMG. STORE** to store the image digitally.
   The thumbnail of the image is displayed on the clipboard.
   See also page 271 for further information.

To store a cineloop

Cineloops may be stored directly or after preview, depending on how the system is configured. The procedure for cineloop storage is described on page 271.

Using removable media

The following removable media can be used for data storage:

- 5 1/4” Magneto Optical disk (1.3, 5.4, 8.6 and 9.1 Gb)
- CD-R (CD-RW is not supported)

△
CAUTION

Use only 24x or higher CD-R.

Recommendation concerning CD-R handling

To avoid data loss, never touch the recordable surface of a CD-R. Handle the disk only by the outer edge. Do not place it face down on a hard surface. Fingerprints or scratches will make the disk unusable. Before usage, verify that CD-R surface has no visible scratches. If there are any scratches, do NOT use the CD-R.

△
CAUTION

Avoid using CD-R to store patient data. The CD-R can be used for storage of images for presentation purposes.

Formatting removable media

Removable media have to be formatted prior to use as described in ’Tools’ on page 435.

Ejecting removable media

Alternative: Press F3. Do not eject the CD using the button on the CD drive.

1. Press ALT+E to eject the disk.
   The *Eject device menu* is displayed (Figure 2-5).

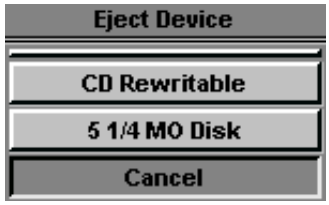


Figure 2-5: The Eject device menu

2. Select the relevant media.

The selected media is ejected.

Recording images on VCR

VCR recording is started and stopped from the **RECORD/PAUSE** key on the control panel. The status of the VCR is indicated by a symbol on the *Title bar* (for detail about how to use VCR recorder, refer to 'VCR operation' on page 384).

Zoom

The unit supports two types of zoom: the display zoom and the high resolution (HR) zoom.

- The Display zoom magnifies the image display in both frozen and live 2D, M-Mode and combined modes.
- The HR zoom concentrates the image processing to a user selectable portion of the image, resulting in an improved image quality and a higher frame rate in the chosen ROI.

1. **High Resolution Zoom**
2. **Magnification control**
3. **Position the zoom area**

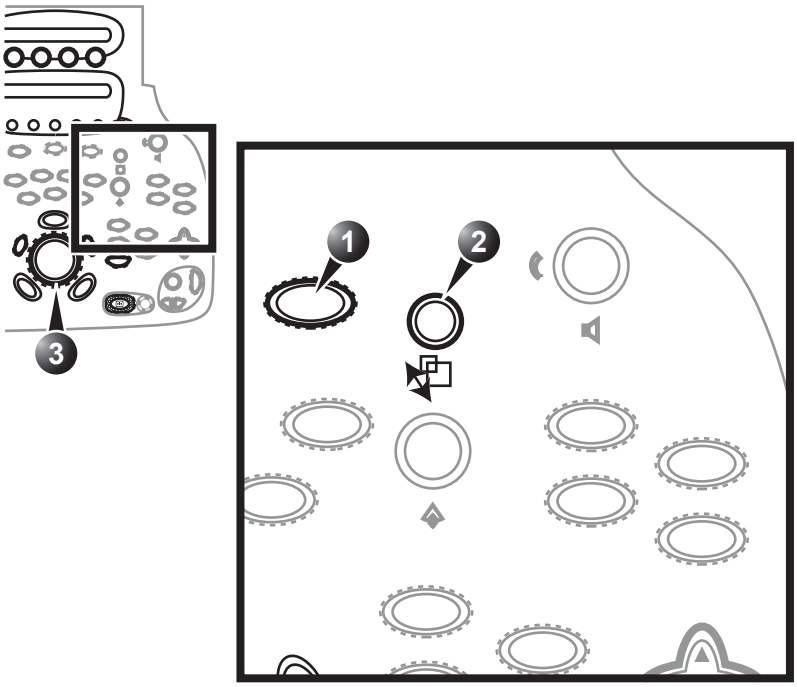


Figure 2-6: The zoom controls

To magnify an image (Display zoom)

The Display zoom is available in live and replay.

1. Rotate the **Zoom knob** clockwise.
   The resulting magnified image appears in the acquisition window while the un-magnified image is displayed in the control window showing the outlined zoom region.
2. Use the **Trackball** to position the zoom area over the desired portion of the image.
3. To turn off the Display zoom, rotate the **Zoom knob** counter clockwise.

To activate the HR zoom

As a default setting, the zoom area is centered to the cursor/color area if present.

1. Press **ZOOM**.
   The resulting zoomed image appears in the acquisition window and a frozen reference image is displayed in the control window showing the outlined zoom region.
2. Use the **Trackball** to position the zoom area over the desired portion of the image.
3. Increase size as desired by turning the zoom knob clockwise.
4. Press **ZOOM** one more time to turn off the HR zoom.

Performing measurements

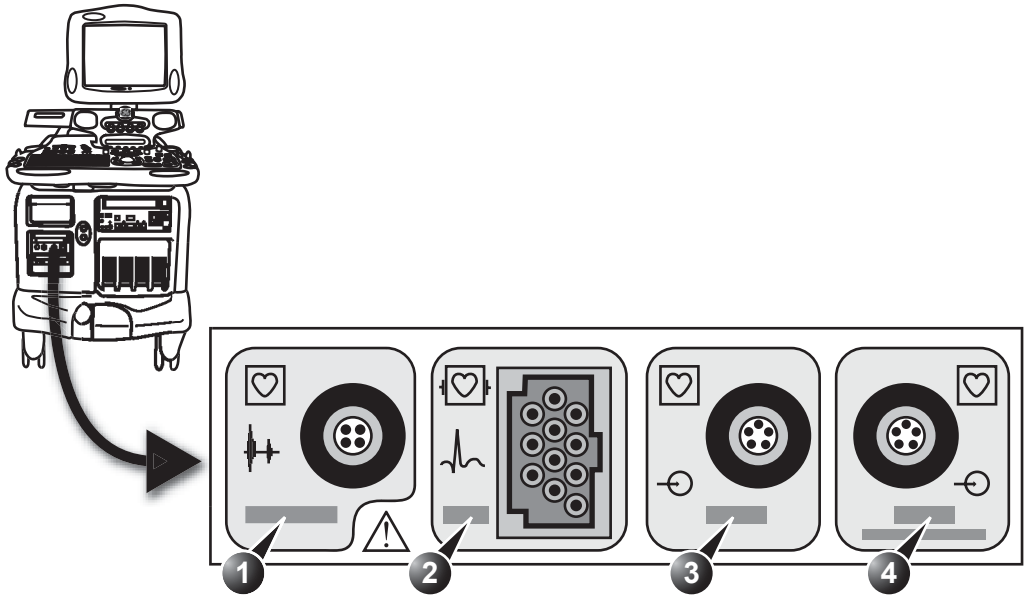
To perform measurements:

1. Press **MEASURE** to enter the Measurement mode.
   Refer to page 209 for further information.

Physiological traces

The physiological module consists of four channels: ECG/ Respiration, Phono, AUX 1 and AUX 2. The two channels AUX1 and AUX2 are both capable of handling external ECG signals from other diagnostic ECG devices. AUX2 is also capable of handling a pulse/pressure signal. The scanned image that is displayed is synchronized with the ECG, respiration and phono traces. In M-Mode or Doppler, the traces are synchronized to that particular mode's sweep.

The operator can control the gain, the position and the sweep rate of the traces using the assignables on the control panel.



1. **Phono**
2. **ECG**
3. **AUX 1**
4. **AUX 2 (Pressure/Pulse)**

Figure 2-7: The patient (I/O) connection panel

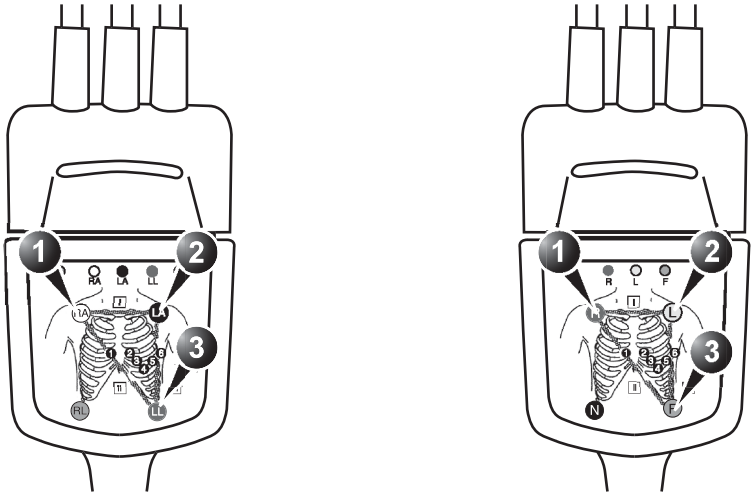
Connecting the ECG/Respiration

Overview

The ECG cable is a modular cable consisting of two different cables parts:

- **The Trunk**: a single cable connecting to the system at one end, and providing a cable splitter device at the other end (see Figure 2-8).
- **The triple color-coded electrode cable**: to be inserted in the splitter device. Each electrode cable hooks up to the appropriate stick-on electrode by a color-coded clip type connector.

The color-coding of the electrodes follows one of two standards that are common in different parts of the world. The cable splitter device has a drawing defining the color codes, names and body location for the two standard color codes (see Figure 2-8).



AHA (USA)

1. **RA: White**
2. **LA: Black**
3. **LL: Red**

IEC (Europe, Asia, ROW)

1. **R: Red**
2. **L: Yellow**
3. **F: Green**

Figure 2-8: The cable splitter device with electrode placement conventions

To connect the internal ECG

1. **Connect** the ECG trunk cable into the rectangular-shaped socket marked *ECG* on the patient trace (I/O) panel. The patient trace (I/O) panel is located in the front left of the ultrasound unit (see Figure 2-7).
2. **Hook up** the electrode cables to the electrodes, following the appropriate convention (see Figure 2-8).

Connecting the Phono

Overview

The phono consists of a microphone with a cable and a connector.

1. **Microphone**
2. **Connector**

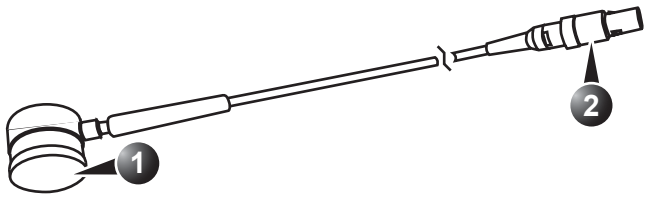


Figure 2-9: The phono device

To connect the Phono

1. **Plug** the connector into the socket marked *Phono* on Patient (I/O) panel (see Figure 2-7).

Connecting the Pulse pressure transducer

Overview

The pulse pressure transducer consists of pulse transducer with a cable and a connector.

1. **Pulse transducer**
2. **Connector**

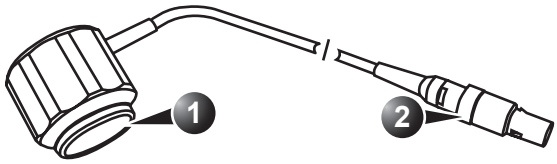
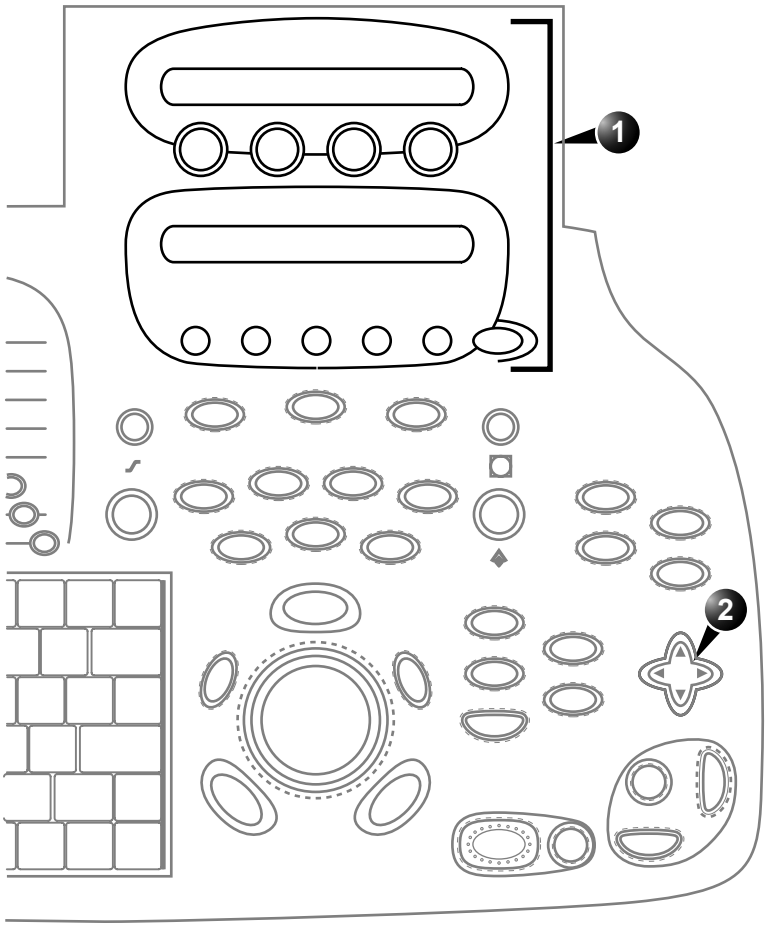


Figure 2-10: The Pulse pressure transducer

To connect the pulse pressure transducer

1. **Plug** the pulse pressure cable into the socket marked *AUX2 Pressure/Pulse* on Patient (I/O) panel (see Figure 2-7).

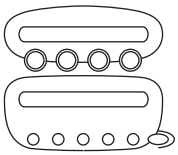
Physio overview



1. **Assignable keys:**
   - **ECG**
   - **Horizontal sweep**
   - **Gain**
   - **Position**
   - **ECG Lead**
   - **ECG Trig**
   - **Timer Trig**
   - **ECG**
   - **Beep**
   - **Phono**
   - **Horizontal sweep**
   - **Gain**
   - **Position**
   - **Phono**
   - **ECG Trig**
   - **Timer Trig**
   - **Phono filter**
   - **Respiration**
   - **Horizontal sweep**
   - **Gain**
   - **Position**
   - **Resp**
   - **ECG Trig**
   - **Timer Trig**
   - **Resp Lead**
   - **AUX 1and AUX 2**
   - **Gain**
   - **Position**
   - **AUX1**
   - **AUX2/Press**
2. **Soft menu**
   - **ECG Trig 1**
   - **ECG Trig 2**
   - **ECG Trig interval**
   - **Timer delay**

Figure 2-11: The physios controls on the front panel

Physio controls



Physio assignable controls

Common controls

Horizontal sweep

Adjust the refresh rate of the physiological trace. This control is active only in 2D and color modes. The sweep speed of the physio traces in M-Mode and Doppler is identical to the M-Mode or Doppler horizontal sweep adjusted by the user.

Gain

Enables the user to change the amplitude of the physiological trace displayed on the screen.

Position

Enables the user to move the physiological trace on the screen.

ECG specific controls

ECG Lead

Enables the user to choose the lead from which the ECG is recorded:

- Lead I: ECG recorded between right and left arm.
- Lead II: ECG recorded between right arm and left leg.
- Lead III: ECG recorded between left arm and left leg.

ECG Trig

Enables intermittent imaging based on the ECG.

Timer Trig

Enables intermittent imaging based on a timer.

ECG

Turns the ECG trace on and off.

Beep

Turns beep sound on and off.

Press **MORE** *to access to the Phono and Respiration controls.*

Phono specific controls

Phono

Turns the phono trace on and off.

Phono filter

Select a phono filter to apply from a pop-up menu.

Respiration specific controls

Respiration

Turns the respiration trace on and off.

AUX specific controls

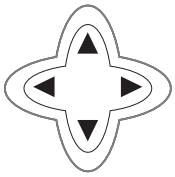
AUX1

Turns the AUX1 physiological trace on and off.

AUX2/Press

Turns the AUX2 physiological trace on and off.

Physio Soft menu controls



ECG Trig 1

Specifies the delay (ms) from R-wave to triggered frame.

ECG Trig 2

Specifies the delay (ms) from R-wave to second frame. Trig 2 must be greater than Trig 1 for dual triggering to be active.

ECG Trig interval

Number of heart cycles between triggered images.

Timer Delay

Controls time between triggers when timer triggering is turned on.

Displaying the physiological traces

Display of the ECG

To turn the ECG display off, press **PHYSIO** *and press the assignable* **ECG**.

Cardiac applications

The ECG is turned on by default in all cardiac applications.

Other applications

1. Press **PHYSIO** on the control panel to get access to the ECG controls.
2. Press the assignable **ECG** to display the trace.

Display of the phono trace

1. Press **PHYSIO** on the control panel.
2. Press **MORE** to display the assignables for the phono trace.
3. Press the assignable **PHONO** to display the trace.

Display of the respiration trace

1. Press **PHYSIO** on the control panel.
2. Press **MORE** twice to display the assignables for the respiration trace.
3. Press the assignable **RESP.** to display the trace.

Display of the pulse pressure trace

1. Press **PHYSIO** on the control panel.
2. Press **MORE** three times to display the assignables for the auxiliary traces
3. Press the assignable **AUX 2** to display the pulse pressure trace.

Adjusting the display of physiological traces

Adjusting the trace sweep speed (ECG, phono and respiration)

1. Press **PHYSIO** on the control panel.
2. Turn the assignable rotary **Horizontal Sweep** to change the sweep speed.

Adjusting the trace amplitude (ECG, phono, respiration and pulse pressure)

The ECG signal's amplitude may vary between patients due to different skin moisture and other physiological parameters.

1. Press **PHYSIO** on the control panel.
2. Press **MORE** to select the actual assignable set.
3. Turn the assignable rotary **Gain** to adjust the amplitude of the trace.

Adjusting the trace position (ECG, phono, respiration and pulse pressure)

1. Press **PHYSIO** on the control panel.
2. Press **MORE** to select the actual assignable set.

3. Turn the assignable rotary **POSITION** to move the trace vertically.

ECG Trigging

1. Press **PHYSIO** on the control panel to access to the ECG controls.
2. Press the assignable **ECG TRIG**.
3. Using the **4-way Rocker**, adjust **Trig 1** to position the first trig on the ECG (delay in ms from R-wave to triggered frame).

*For dual triggering **Trig 2** must be grater than **Trig 1**.*

4. Using the **4-way Rocker**, highlight **Trig 2** if dual triggering is to be used.
5. Adjust **Trig 2** to position the second trig on the ECG.
6. Using the **4-way Rocker**, highlight **Trig Interval**.
7. Using the **4-way Rocker**, adjust the number of heart cycles between triggered frame acquisition.

Annotations

Text annotations may be inserted anywhere on the screen. The annotation can be free text or a pre-selected text from a mode-specific annotation pop-up menu. The *Annotation menu* is user-configurable (see page 84).

1. **Free text**
2. **Draw an arrow**
3. **Edit previous annotation**
4. **Configure annotation list**
5. **Pre-defined mode-specific annotations**
6. **Exit annotation mode**

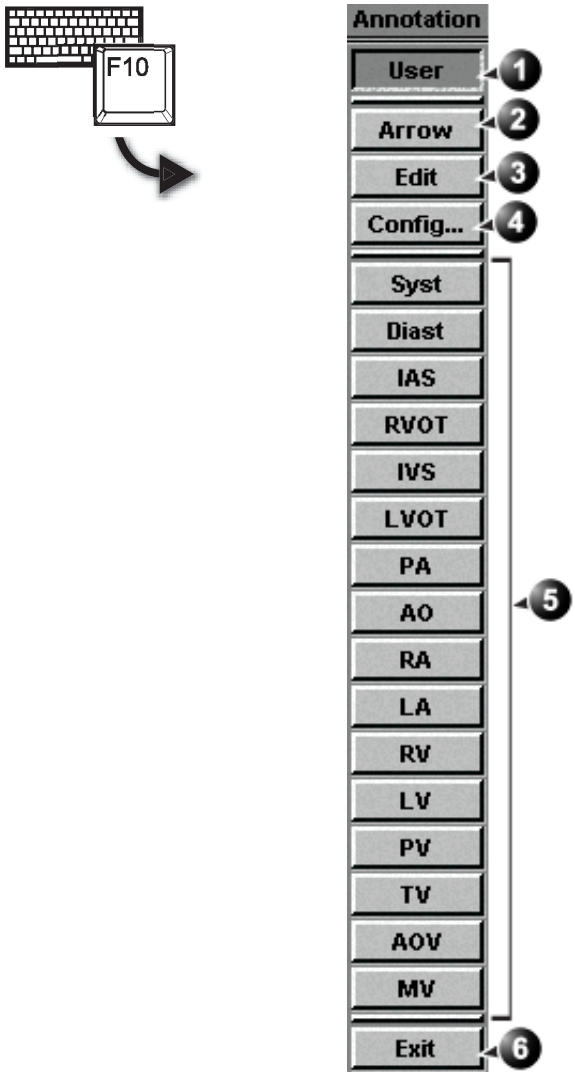


Figure 2-12: The mode-specific annotation menu

To insert an annotation

Free text

While typing, use **BACKSPACE** *to delete backward.*

1. Press the alphanumeric key **TEXT** (**F10**).
   The *Annotation menu* is displayed (see Figure 2-12).
2. Press **User**.
3. Type the required text.
4. Trackball the text entered to the insertion position.
5. Press **SELECT** to add the annotation.
6. Press Exit in the *Annotation menu*.

Pre-defined annotation

1. Press the alphanumeric key **TEXT** (**F10**).
   A list of mode-specific abbreviations is displayed (see Figure 2-12).
2. Trackball to the required abbreviation.
3. Press **SELECT**.
4. Trackball to the position at which the annotation is to be inserted.
5. Press **SELECT** to add the annotation.

To draw an arrow

1. Press **Arrow** in the *Annotation menu*.
2. Trackball to the start position of the arrow to draw.
3. Press **SELECT** to anchor the arrow.
4. Trackball to the end position of the arrow to draw.
5. Press **SELECT** to fix the arrow.

To edit annotation

1. Press the alphanumeric key **TEXT** (**F10**).
2. Press **Edit** in the *Annotation menu*.
   The pointer is changed to a cross marker.
3. Trackball to the annotation to edit.
4. Press **SELECT**.
   Once selected, the annotation can be moved freely.
   The text can be edited using the following alphanumeric keys:
   - **RIGHT ARROW**: moves the text cursor forward.

- **LEFT ARROW**: moves the text cursor backward
- **BACKSPACE**: deletes backward.
- **DELETE**: deletes the text forward.
- **INSERT**: toggles the text entry state from overwrite to insert mode.

5. Do the appropriate changes to the annotation.
6. Press **SELECT** to anchor the edited annotation.

To erase annotation

The user can erase all annotations on the screen in one operation or erase annotations one by one.

To erase all annotations

1. Press the alphanumeric key **PAGE ERASE** (**F7**).

To erase one annotation

1. Press the alphanumeric key **LINE ERASE** (**F8**).
   The cursor is changed to a cross marker.
2. Trackball to the annotation to delete.
3. Press **SELECT** to erase the annotation.

Configuration of the pre-defined annotation list

1. Press **config** in the *Annotation menu*.
   A configuration dialogue window is displayed (see Figure 2-13) where the user can add, delete or re-arrange the annotation text.

To re-arrange the annotation list

1. Trackball to the actual annotation text.
2. Press **SELECT**.
3. Press the relevant button (i.e **Delete**, **Move up** or **Move down**) to apply change.
4. Press **save** to store the new annotation list.

To add an annotation text

1. Trackball to the text entry field (see Figure 2-13).
2. Press **SELECT** to activate the text cursor.

3. Type the new annotation text.
4. Press **add**.
   The new annotation text is added at the end of the list.
5. Press **save** to store the new annotation list.

1. **Rearrange list**
2. **Delete selected text**
3. **Reset to factory default**
4. **Add new text to the list**
5. **Enter new text**
6. **Selected text**

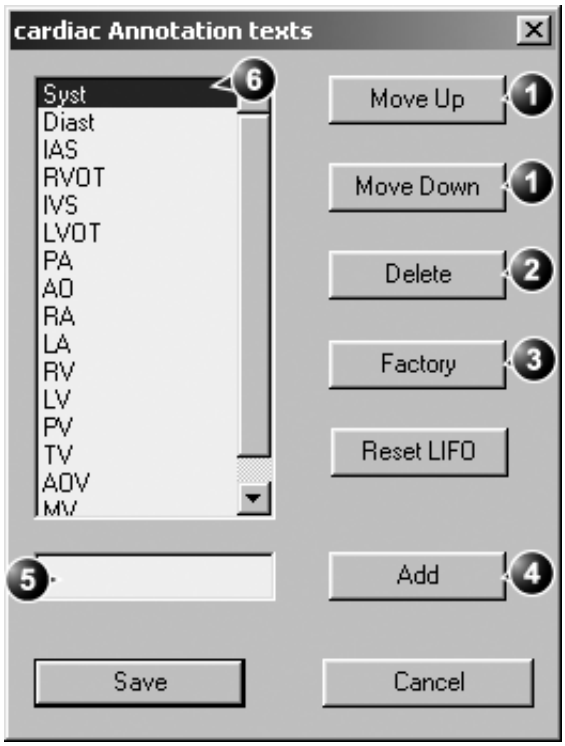


Figure 2-13: The configuration dialogue box for the annotation menu

Bodymarks

Bodymarks are small graphic images that represent the anatomy being examined. Using bodymarks, the user can indicate the position that the probe was in during the examination.

Inserting a bodymark

1. Press the alphanumeric key **BODYMARK** (**F6**).
   The *Bodymark menu* is displayed showing a selection of bodymarks relative to the selected exam category.

1. **Select and display bodymark list for other applications**
2. **Edit probe marker position and orientation**
3. **Erase bodymark**
4. **Bodymark list for the current application**
5. **Insert an arrow**
6. **Insert user-defined text**

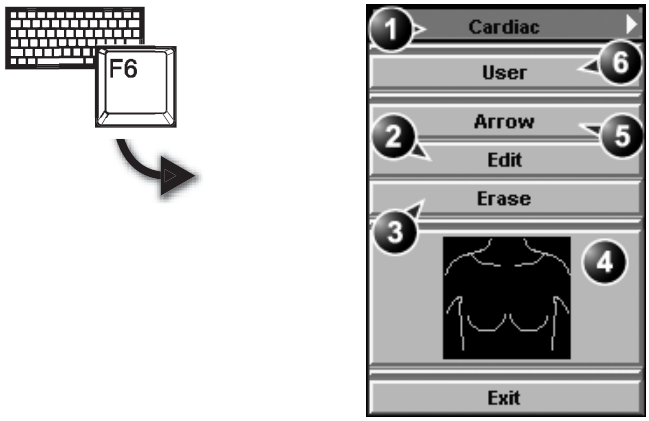


Figure 2-14: The Bodymark menu

2. Trackball to the desired bodymark and press **SELECT**.
   The bodymark with a probe marker is displayed on the scanning screen.

1. **Probe marker**

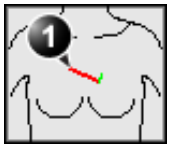


Figure 2-15: The bodymark with probe marker

3. Using the trackball, adjust the position of the probe marker and press **SELECT**.

4. Using the trackball, adjust the probe marker orientation and press **SELECT**.

Editing a bodymark

1. Press the alphanumeric key **BODYMARK** (**F6**).
   The *Bodymark menu* is displayed
2. Press **Edit**.
3. Using the trackball, adjust the position of the probe marker and press **SELECT**.
4. Using the trackball, adjust the probe marker orientation and press **SELECT**.

Deleting a bodymark

1. Press the alphanumeric key **BODYMARK** (**F6**).
   The *Bodymark menu* is displayed
2. Press **Delete**.

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Introduction

The Vivid 7/Vivid 7 PRO ultrasound scanner provides several basic scanning modes and several options for combining the use of these modes.

The following scanning modes are described in this chapter:

- 2D Mode Imaging
- M-Mode Imaging
- Anatomical M-Mode (straight and curved)
- Color Mode Imaging
- Angio
- Doppler Mode Imaging
- Tissue Velocity Imaging

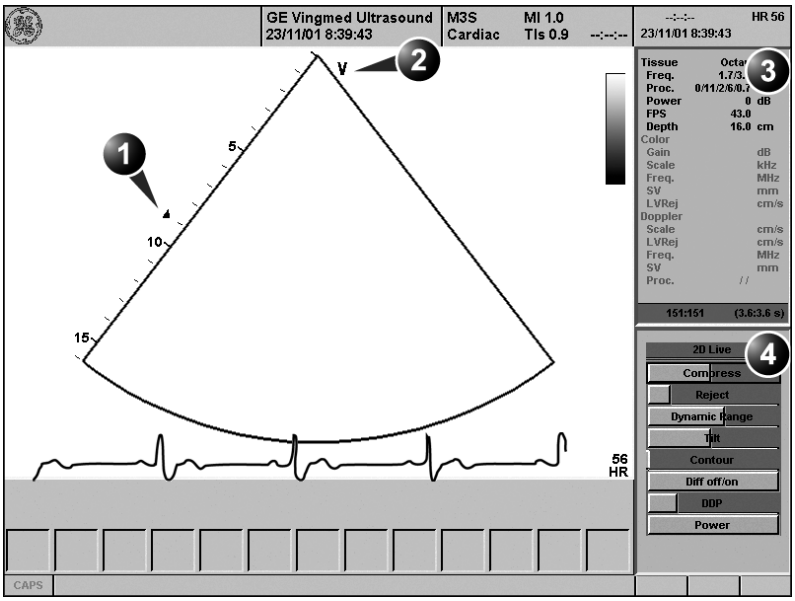
When performing an examination using any of these modes, images and image sequences (cineloops) can be stored. The examination or part of it can also be stored on video tape.

See page 271 for further information on image and cineloop storage. Refer to page 381 for more information on VCR recording.

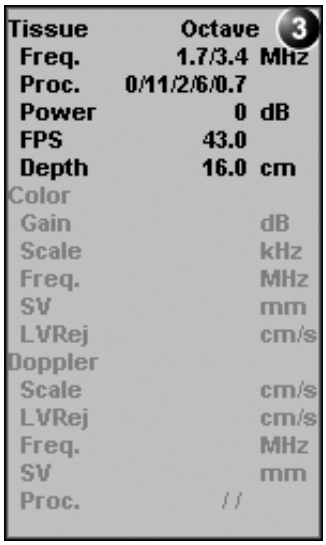
2D-Mode

2D-Mode overview

1. **Focus marker**
2. **Probe orientation marker**
3. **Status window:**
4. **Soft menu**



Controls marked with R are also available in freeze and cine replay.



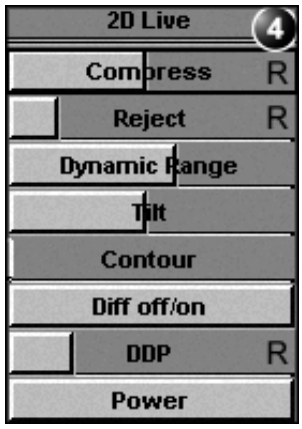
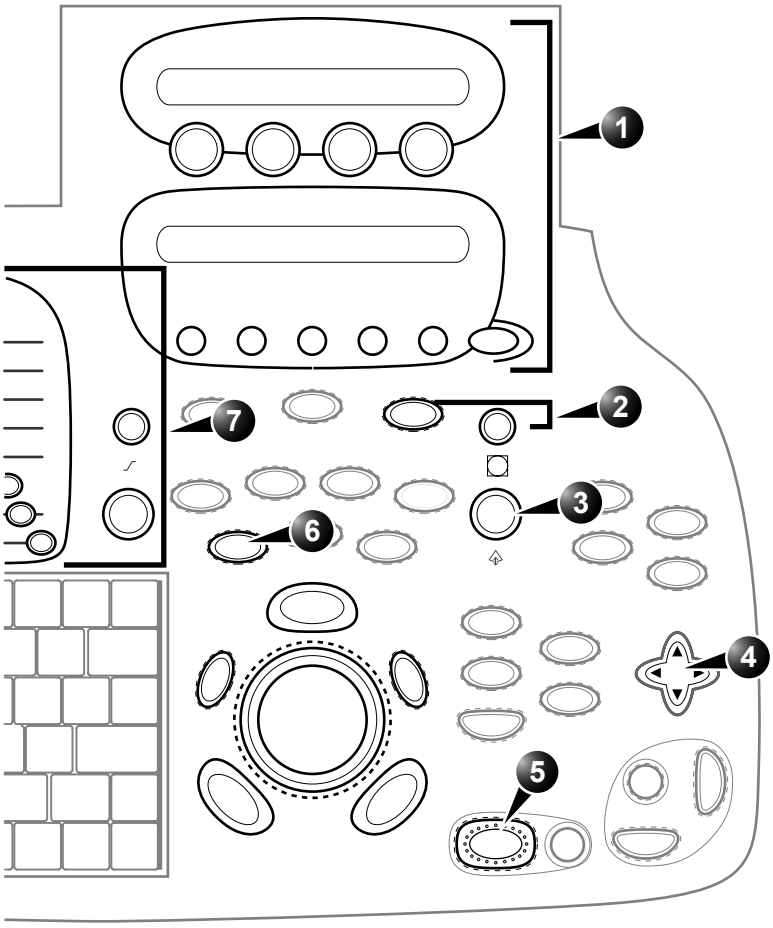


Figure 3-1: The 2D screen (cardiac)



1. **Assignable keys:**
   - **Width**
   - **Frequency/Resolution**
   - **Focus**
   - **Frame rate**
   - **Up/Down R**
   - **Left/Right R**
   - **Cineloop (in Freeze, only)**
   - **Dual focus**
   - **B color maps**
   - **Select all**
2. **Zoom**
3. **Depth**
4. **Soft menu**
   - **Compress R**
   - **Reject R**
   - **Dynamic Range**
   - **Tilt**
   - **Contour**
   - **Diff On/Off**
   - **DDP R**
   - **Power**
   - **Start/stop cineloop**
5. **Freeze**
6. **2D**
7. **Gain**

Controls marked with ***R*** are also available in freeze and cine replay

Figure 3-2: The 2D controls on the front panel

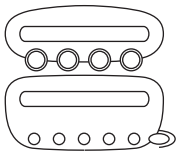
The 2D mode displays a two-dimensional gray scale image of the tissue within the probe's field of view. 2D mode can be combined with:

In combined mode, press **ACT. MODE** *to toggle between modes and access to the mode specific controls.*

- M-Mode, see 'M-Mode' on page 98
- Color Mode, see 'Color Mode' on page 104
- CW or PW Doppler Mode, see 'PW and CW Doppler' on page 112
- Color and Doppler Modes (triplex)

2D-Mode controls

2D assignable controls



Width

Controls the size or angular width of the 2D image sector. A smaller angle generally produces an image with a higher frame rate.

Focus

Changes the location of the focal point(s). A triangular focus marker indicates the depth of the focal point.

Frame rate

Adjusts frame rate (FPS). Rotate the knob clockwise to increase frame rate. The relative setting of the frame rate is displayed in the status window. When adjusting frame rate, there is a trade off between spatial and temporal resolution.

Frequency/Resolution

On some low frequencies, the system switches automatically to second-harmonic mode. The word "Octave" appears in the status window.

Enables the adjustment of the probe's operating frequency. Rotate the knob clockwise to increase the frequency. The selected frequency is displayed in the status window. For some probes/applications the lowest frequency settings will be Octave imaging settings.

Invert

- **Left/Right Invert**: enables a mirror image of the 2D image to be created. The left/right reference marker **V** moves to the other side of the image.
- **Up/Down Invert**: enables the 2D image to be flipped 180 degrees.

Dual focus

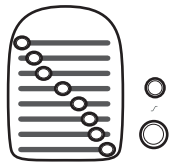
Activates Dual focus mode. To adjust the Dual focus, rotate the **FOCUS** assignable.

Color maps

Displays a color map menu to optimize the greyscale presentation. The menu enables an option from a list of non-linear gray-curves or different 2D-colorized curves to be selected.

Cineloop (in Freeze only)

Starts cineloop acquisition.



Gain

When rotated clockwise, increases the overall gain applied to the received echo signals equally for all depth.

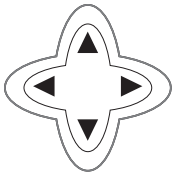
Time Gain Compensation (TGC)

compensates for depth-related attenuation in an image. The sliders nearest the operator affect the far field. TGC amplifies returning signals to correct for the attenuation caused by tissue at increasing depths.

Depth

Sets the maximum (far field) distance that will be imaged. Decreasing the depth may allow higher frame rates.

2D Soft menu controls



Compress

Controls the amount of contrast in the 2D image. An index number is displayed in the status window to indicate the relative level of compression.

Contour

Controls image processing related to the extent of edge enhancement applied to an image.

Reject

Adjust reject level. When this control is increased, low-level echoes are rejected and appear darker in the 2D image. An index number is displayed in the status window to indicate the relative level of rejection.

Tilt

Enables the axis of the 2D image to be tilted to the left or right. By using this control in combination with angle control the image can be “aligned” to the direction of interest, and frame rates be optimized. By default the axis of symmetry of a 2D image is vertical.

DDP (Data Dependent Processing)

Performs temporal processing which reduces random noise without affecting the motion of significant tissue structures. An index number is displayed in the status window (under Proc) to indicate the relative DDP level.

Diff On/Off

Affects the level of reverberations in the image. When turned on, the frame rate (or the number of focal zones) will decrease, while the reverberations will be attenuated.

Power

When power is reduced, it reduces the signal-to-noise ratio, so that the image may become noisier.

Controls the amount of acoustic power applied in all modes. When power is set to maximum, it is equal to or less than the maximum acoustic power permitted by the FDA. The Thermal Index (TI) and the Mechanical Index (MI) are displayed on the screen.

Dynamic Range

Enables control of the dynamic range or contrast of the image. When dynamic range is set high, the image is softer and more low-level data is visible.

Using 2D

Refer to page 400 about creating presets.

Check the Display's brightness and contrast setting before adjusting the unit imaging controls

The 2D-Mode is the system's default mode.

1. Press **2D** on the control panel to access 2D mode.
2. Optimize the image by adjusting the image controls described in the previous section.
   If necessary use preset for optimum performance with minimum adjustment.

Optimizing 2D

The following controls can be adjusted to optimize the 2D Mode display:

- Use the **Gain** and **TGC** controls to optimize the overall image.
- Use the **Depth** control to adjust the range to be imaged.
- Use the **Focus** control to center the focal point(s) around the region of interest.
- Use the **Frequency** (move to higher frequencies) or the **Frame rate** control (move to lower frame rate) to increase resolution in image
- Use the **Frequency** (move to lower frequency) to increase penetration.
- Use the **Reject** control to reduce noise in the image.
- Use the **DDP** control to optimize imaging in the blood flow regions and make a cleaner, less noisy image.

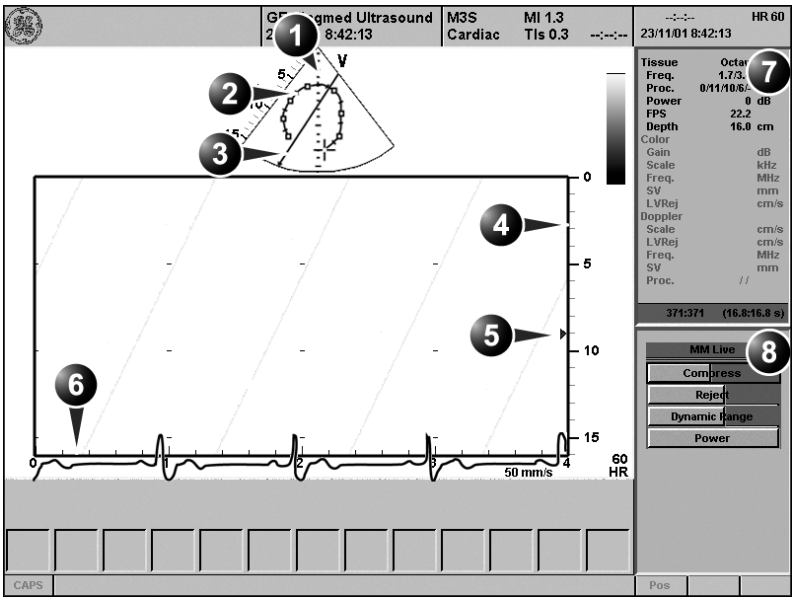
WARNING

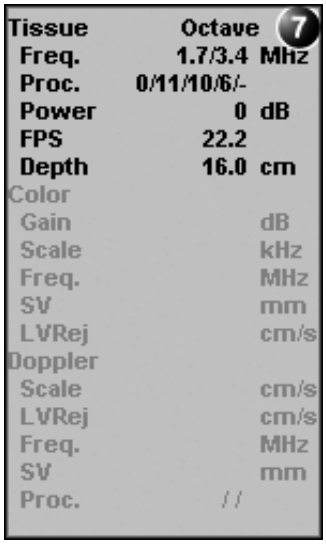
Always use the minimum power required to obtain acceptable images in accordance with applicable guidelines and policies.

M-Mode

M-Mode overview

1. **Time motion cursor conventional M-Mode**
2. **Time motion cursor curved anatomical M-Mode**
3. **Time motion cursor anatomical M-Mode**
4. **Depth scale**
5. **Focus marker**
6. **Time scale**
7. **Status window:**
8. **Soft menu**





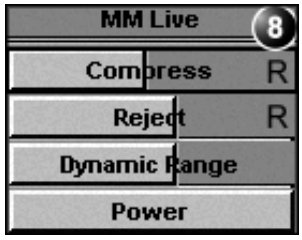
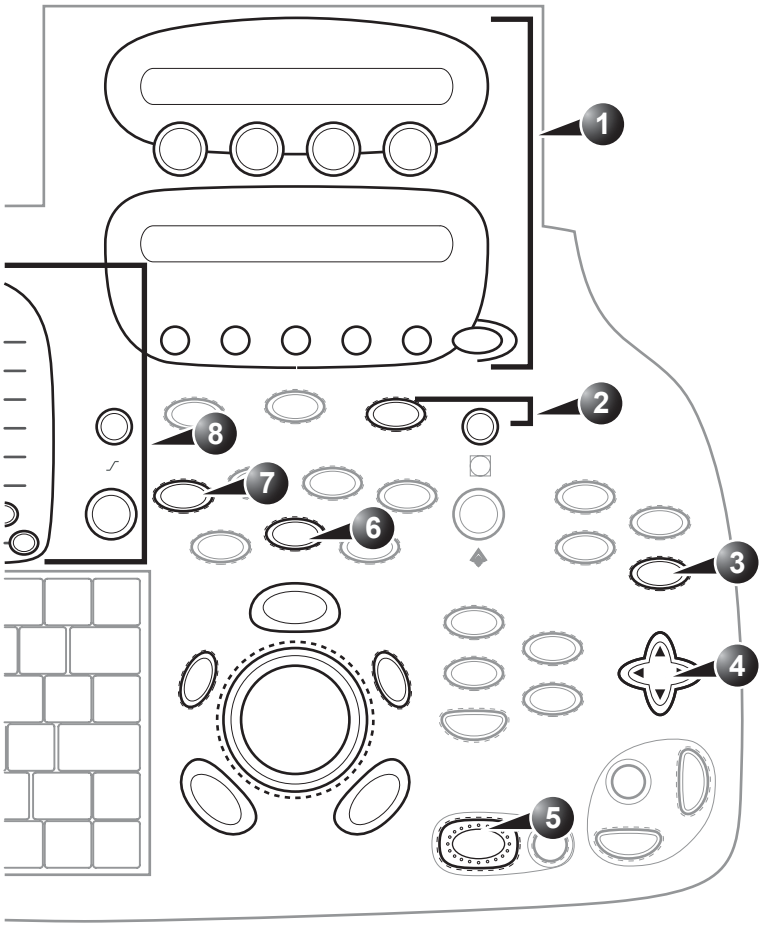


Figure 3-3: The cardiac M-Mode screen (top/bottom)



1. **Assignable keys:**
   - **Horizontal sweep R**
   - **Frequency/Resolution**
   - **Focus**
   - **Contour**
   - **Up/Down**
   - **Color maps**
2. **Zoom**
3. **Img Size**
4. **Soft menu**
   - **Compress R**
   - **Reject R**
   - **Dynamic Range**
   - **Power**
5. **Freeze**
6. **M-Mode**
7. **Access to AMM & CAMM**
8. **Gain R**

Controls marked with ***R*** are also available in freeze and cine replay

Figure 3-4: The M-Mode controls on the front panel

This unit has three types of M-Mode:

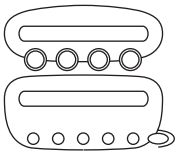
- Conventional M-Mode (MM): displays a distance/time plot of a cursor line in the axial plane of the 2D-image.
- Anatomical M-Mode (AMM): displays a distance/time plot from a cursor line, which is independent from the axial plane. AMM is available in greyscale, color, TVI, Tissue Tracking, Strain rate and Strain modes.
- Curved Anatomical M-Mode (CAMM): displays a distance/time plot from a free-drawn cursor line. CAMM is available in greyscale, color, TVI, Tissue Tracking, Strain rate and

Strain modes.

M-Mode and 2D Mode display areas can be side by side or top/bottom. Conventional M-Mode can be combined with Color (see 'Color M-Mode overview' on page 105).

M-Mode controls

M-Mode assignable controls



Horizontal sweep

Adjusts the horizontal refresh rate of the M-Mode area of the display. Horizontal sweep does not change the acquisition resolution, so that user can change the horizontal sweep in replay (with no loss of quality).

On some low frequencies, the system switches automatically to second-harmonic mode. The word "Octave" appears in the status window.

Frequency/Resolution

Enables the adjustment of the probe's operating frequency. Rotate the knob clockwise to increase the frequency. The selected frequency is displayed in the status window. For some probes/applications the lowest frequency settings will be Octave imaging settings.

Focus

Changes the location of the focal point(s). A triangular focus marker indicates the depth of the focal point.

Contour

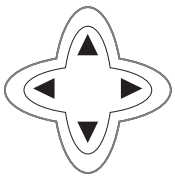
Controls image processing related to the extent of edge enhancement applied to an image.

Up/Down

Flips the M-Mode display 180 degrees.

Color maps

Displays a color map menu to optimize the greyscale presentation. The menu enables an option from a list of non-linear gray-curves or different colorized curves to be selected.



M-Mode Soft menu controls

Compress

Controls the amount of contrast in the image. An index number is displayed in the status window to indicate the relative level of compression.

Reject

Adjust reject level. When this control is increased, low-level echoes are rejected and appear darker in the image. An index number is displayed in the status window to indicate the relative level of rejection.

Power

When power is reduced, it reduces the signal-to-noise ratio, so that the image, spectrum or color scan may become noisier.

Controls the amount of acoustic power applied in all modes. When power is set to maximum, it is equal to or less than the maximum acoustic power permitted by the FDA. The Thermal Index (TI) and the Mechanical Index (MI) are displayed on the screen.

Dynamic Range

Enables control of the dynamic range or contrast of the image. When dynamic range is set to High, the image is softer and more low-level data is visible.

Using M-Mode

Conventional M-Mode

1. To access M-Mode from any other scan mode, press **MM** on the control panel.
2. Use the **trackball** to position the cursor over the required area of the image.

Gain, Frequency, Focus, Dynamic Range and Compression affect also the 2D image.

3. Adjust horizontal sweep, Gain, Frequency, Focus, Dynamic Range, Compression and Contour to optimize the display if necessary.
4. Press **FREEZE** to stop imaging.

Anatomical M-Mode

Anatomical M-Mode can also be used with previously acquired digitally stored 2D images.

1. From the 2D Live or M-Mode view, press **ALT**.
   The alternative modes are displayed on the assignable.
2. Press **AMM**

OR

1. From the 2D Live, press **FREEZE**.
2. Press **MM** to access the Anatomical M-Mode.

*The Trackball assignable **Pos** (Position) is activated.*

3. Use the **trackball** to position the cursor over the required area of the image.

*The Trackball assignable **Angle** is activated.*

4. Press **TRACKBALL** to allow free rotation of the solid full-length cursor line throughout the 2D image.
5. Rotate the solid cursor line to the desired direction.

*The Trackball assignable **Pos** is activated.*

6. Press **TRACKBALL** twice and reposition the intersection point to the desired position along the cursor line.
7. Repeat steps 4. and 5. to change the angle of the solid cursor line if necessary.

The M-Mode area of the display updates as the M-Mode signal is constructed.

8. Press **TRACKBALL** to activate scrolling control on the trackball.
9. Use the **trackball** to scroll through the data acquired at that location. The M-Mode display will vary accordingly.

Curved Anatomical M-Mode

Curved Anatomical M-Mode can also be used with previously acquired digitally stored 2D images.

1. From the 2D or M-Mode view press **ALT**.
   The alternative modes appear on the assignable display.
2. Press **CURVED AMM**.

3. Use the **trackball** to position the starting point of the time motion curve.
4. Press **SELECT** to anchor the starting point of the time motion curve.
5. Use the **trackball** to position the second point of the time motion curve.
6. Press **SELECT** to anchor the second point of the time motion curve.
7. Repeat step 5. and 6. up to seven times to draw a complete time motion curve.

The time motion curve can be edited by following the curve back to the desired point and redrawn as desired. Following the curve back to the starting point will delete the time motion curve.

Optimizing M-Mode

Refer to page 400 about creating presets.

The use of preset gives optimum performance with minimum adjustment. If necessary, the following controls can be adjusted to further optimize the M-Mode display:

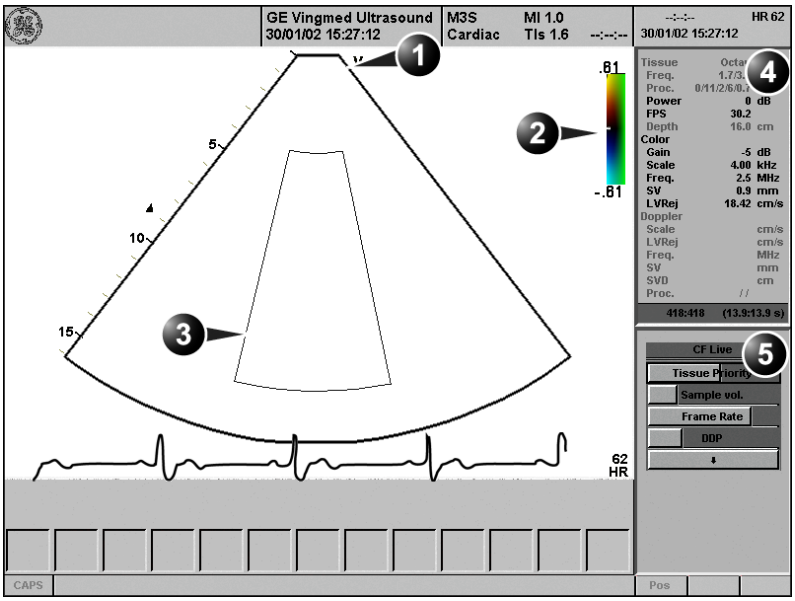
- Adjust **Horizontal sweep** to optimize the display resolution.
- Adjust **Gain** and **TGC** controls to adjust the range to be imaged.
- Use the **Frequency** (move to higher frequencies) or the **Frame rate** control (move to lower frame rate) to increase resolution in image.
- **Use the Frequency (move to lower frequency) to increase penetration**.
- Adjust **Focus** to move the focal point(s) around the region of interest in the M-Mode display.
- Adjust **Dynamic range** to optimize the useful range of incoming echoes to the available greyscale.
- Adjust **Compress** and **Contour** to further optimize the display.
- Adjust **Reject** to reduce noise while taking care not to eliminate significant low-level diagnostic information.

*Except for **Contour**, all the controls listed in the optimizing M-Mode section will also affect the 2D image.*

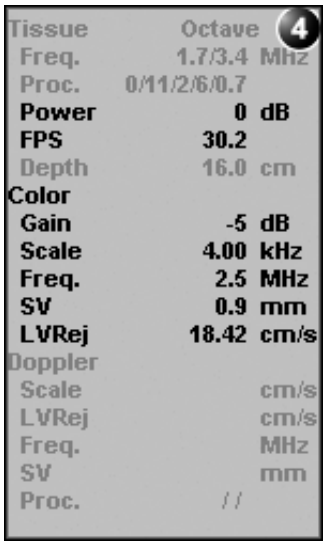
Color Mode

Color 2D Mode overview

1. **Probe orientation marker**
2. **Color bar**
3. **Color sector marker**
4. **Status window:**
5. **Soft menu**



Controls marked with **R** are also available in freeze and cine replay.



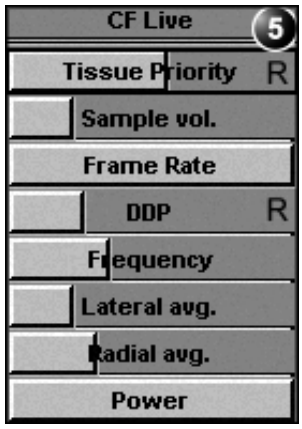
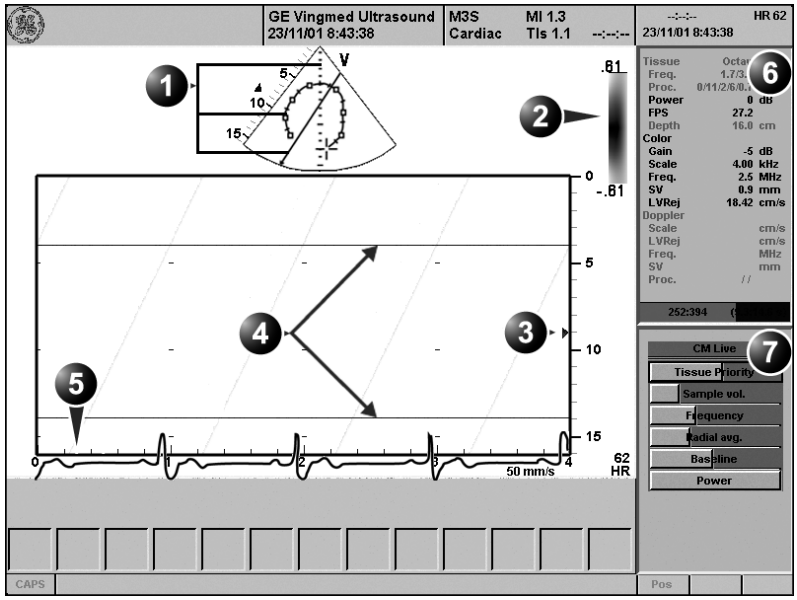


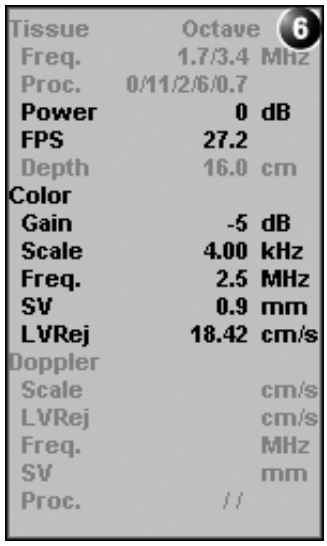
Figure 3-5: The Color Mode screen

Color M-Mode overview

1. **Time motion cursors**
2. **Color bar**
3. **Focus marker**
4. **Flow sector marker**
5. **Time scale**
6. **Status window:**
7. **Soft menu**



Controls marked with **R** are also available in freeze and cine replay.



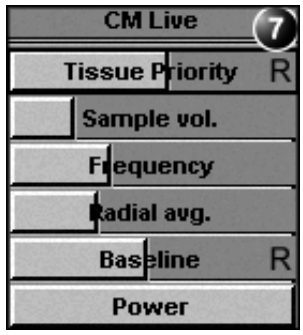
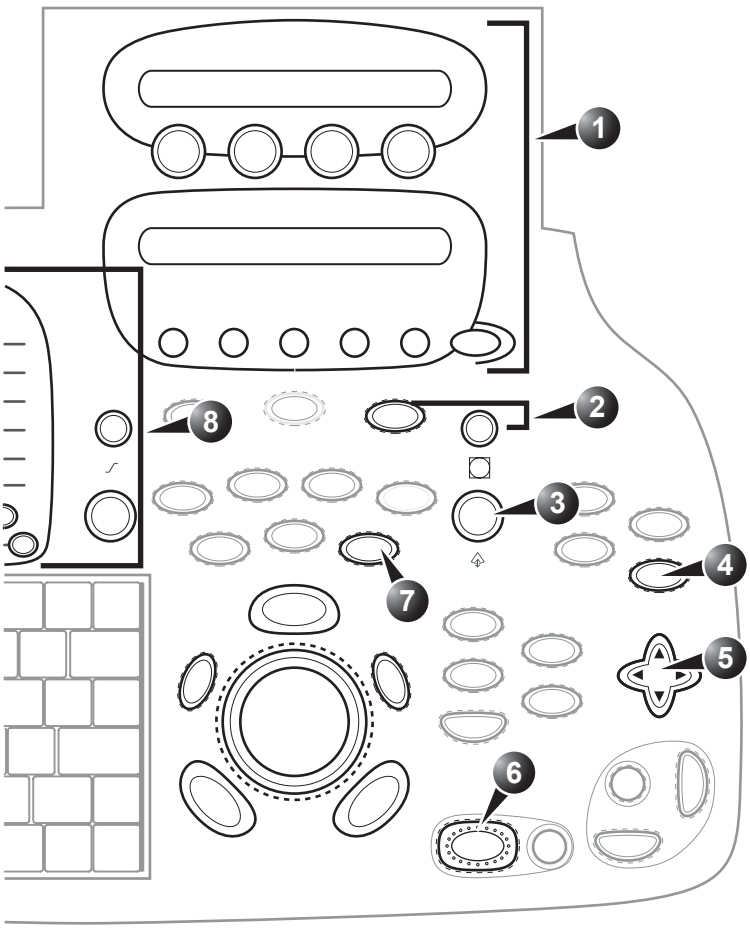


Figure 3-6: The Color M-Mode screen (top/bottom display)



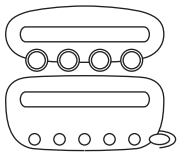
1. **Assignable keys:**
   - **Horizontal sweep (Color M-Mode only) R**
   - **Scale**
   - **LVR**
   - **Invert R**
   - **Variance R**
   - **Dual focus**
   - **Color maps**
   - **Angio (Color 2D only)**
   - **Cineloop (in Freeze, Color 2D mode only)**
2. **Zoom**
   - **Display zoom**
   - **HR zoom**
3. **Img Size (Color M-Mode)**
4. **Soft menu**
   - **Sample Volume**
   - **Tissue Priority R**
   - **DDP (Color 2D only) R**
   - **Frequency**
   - **Radial avg.**
   - **Lateral avg.**
   - **Power**
5. **Freeze**
6. **Color**
7. **Access to AMM & CAMM**
8. **Gain R**

Controls marked with ***R*** are also available in freeze and cine replay

Figure 3-7: The Color Mode controls on the front panel

Color Mode controls

Color Mode assignable controls



Horizontal sweep (Color M-Mode only)

Adjusts the horizontal refresh rate of the M-Mode area of the display.

Scale

Adjusts the repetition rate of the Doppler pulses transmitted to acquire the data for color flow mapping. The Scale (Nyquist limit) should be adjusted so that no aliasing occurs, while still having good resolution of velocities. The Nyquist limit should be somewhat above the maximum velocity found in the data.

Baseline

Adjusts the color map to emphasize flow either toward or away from the probe. Baseline is available in both Live and Freeze.

LVR (Low Velocity Rejection)

Color data produced by very low flow may cause interference.

LVR, also called Wall motion filter, enables the extent of low velocity removal to be adjusted.

Invert

Enables the color scheme assigned to positive and negative velocities to be inverted. Invert is available in live and cine replay.

Variance

Controls the amount of variance data added to a color display. Variance enables computer-aided detection of turbulent flow (e.g. jets or regurgitation). Variance is available in live and cine replay.

Dual focus (Color 2D mode only)

Activates Dual focus mode. To adjust the Dual focus, press **ACT. MODE** and rotate the **FOCUS** assignable.

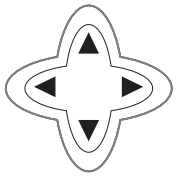
Color maps

Displays a menu of color map options. Use the **trackball** to point to a color map and press **SELECT** to activate the desired color map. Each color map is assigning different color hues to different velocities.

Cineloop (in Freeze, Color 2D mode only)

Starts cineloop acquisition.

Color-Mode Soft menu controls



Sample volume

Adjusts the size of the color flow Doppler sampling area. Lower setting gives better flow resolution while a higher setting increases sensitivity and helps to locate turbulent flows.

Tissue priority

Emphasize either the color of the color mode or the greyscale tissue detail of the 2D image. Tissue priority is available in both Live and Freeze.

Frequency

Enables the adjustment of the transmission frequency to control the sensitivity or the level of penetration. The selected frequency is displayed in the status window. Adjusting Frequency may affect Sample Volume and LVR settings.

Radial Averaging

Use Averaging controls with caution so as not to obscure significant diagnostic information

Smooths the image by averaging collected data along the same radial line. An increase of the radial averaging will reduce noise, but this will also reduce the radial resolution.

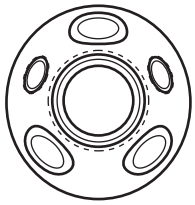
Lateral Averaging (Color 2D only)

Smooths the image by averaging collected data along the same horizontal line. An increase of the lateral averaging will reduce noise, but this will also reduce the lateral resolution.

Power

When power is reduced, it reduces the signal-to-noise ratio, so that the image may become noisier.

Controls the amount of acoustic power applied in all modes. When power is set to maximum, it is equal to or less than the maximum acoustic power permitted by the FDA. The Thermal Index (TI) and the Mechanical Index (MI) are displayed on the screen.



Trackball controls

ROI (Region Of Interest) size

When the trackball command **Size** is selected (see also 'Trackball operation' on page 59), the height and width of the color area (or ROI) is adjusted from the trackball.

ROI (Region Of Interest) position

When the trackball command **Pos** (position) is selected (see also 'Trackball operation' on page 59), the position of the color area (or ROI) is adjusted with the trackball.

Using Color Mode

Color 2D

1. From an optimized 2D image press **COLOR**.
2. Use the **trackball** to position the ROI frame over the area to be examined.
3. Press **TRACKBALL**. The instruction **Size** should be highlighted in the trackball status bar. If not, press **TRACKBALL** again to select **Size**.

The assignable controls of the trackball are displayed in the trackball status bar in the bottom right corner of the screen.

4. Use the **trackball** to adjust the dimensions of the ROI.
   To enlarge or narrow the ROI, move the **trackball** to the left or right.
   To lengthen or shorten the ROI, move the **trackball** up or down.
5. Press **SELECT** when the desired size is obtained.
6. Press **FREEZE** to stop imaging.

Color M-Mode

1. From M-Mode press **COLOR**.
2. Use the **trackball** to position the color area in the M-Mode display.
3. Press **TRACKBALL**. The instruction **Size** should be highlighted in the trackball status bar. If not, press **TRACKBALL** again to select **Size**.

The assignable controls of the trackball are displayed in the trackball status bar.

4. Use the **trackball** to adjust the dimension of the color area.
   To enlarge the color area, move the **trackball** up
   To narrow the color area, move the **trackball** down.
5. Press **SELECT** when the desired size is obtained.

Optimizing Color Mode

Refer to page 400 about creating presets.

The use of preset gives optimum performance with minimum adjustment. If necessary, the following controls can be adjusted to further optimize the Color Mode display:

- Adjust the **Active mode gain** to set the gain in the color flow area.

The scale value may affect FPS, Low Velocity Reject, and Sample Volume.

- Adjust **Scale** to the highest setting that provides adequate flow detection.
- Adjust ***Low Velocity Reject*** to remove low velocity blood flow and tissue movement that reduces image quality.
- Adjust **Variance** to detect flow disturbances.
- Adjust **Sample volume** (SV) to a low setting for better flow resolution, or a higher setting to more easily locate disturbed flows

Frequency setting may affect FPS, SV and Low Velocity Reject.

- Adjust **Frequency** to optimize the color flow display. Higher settings improve resolution. Lower settings improve depth penetration and sensitivity. This does not affect the frequency used for 2D and M-Mode.

The Power setting affects all other operating modes.

- Adjust **Power** to obtain an acceptable image using the lowest setting possible.

Adjust the following settings to further optimize display of the image:

- Use **Invert** to reverse the color assignments in the color flow area of the display.
- Use **Tissue priority** to emphasize either the color flow overlay, or the underlying greyscale tissue detail.
- Use **Baseline** to emphasize flow either toward or away from the probe.
- Use **Radial** and **Lateral Averaging** to reduce noise in the color flow area. Radial and Lateral Averaging smooths the image by averaging collected data along the same horizontal line. An increase of the lateral averaging will reduce noise, but this will also reduce the lateral resolution.

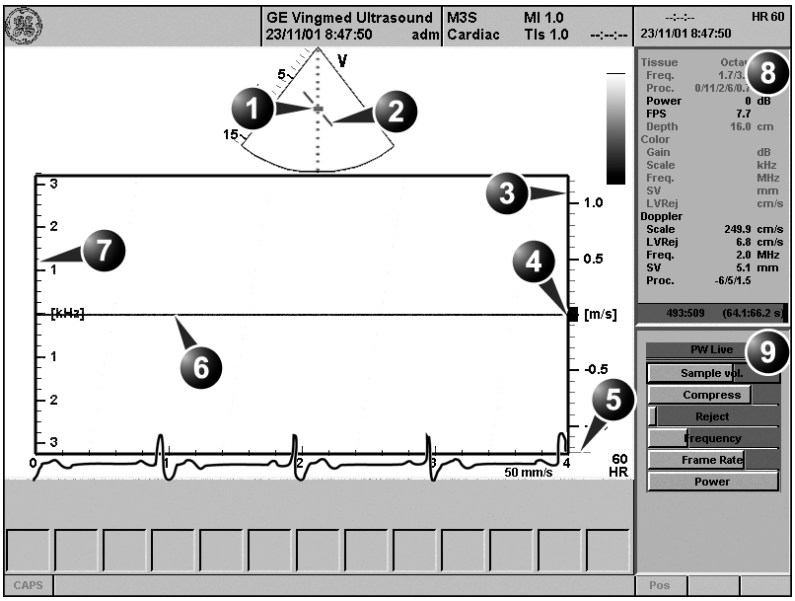
△
CAUTION

Use all noise reduction controls with care. Excessive application may obscure low level diagnostic information.

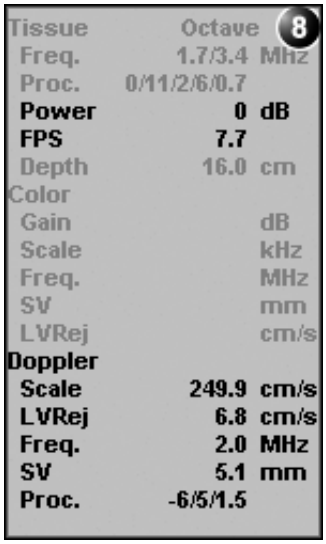
PW and CW Doppler

PW and CW Doppler overview

1. **Sample volume (PW only)**
2. **Angle correction marker**
3. **Velocity scale**
4. **Low velocity reject**
5. **Nyquist velocity**
6. **Doppler baseline**
7. **Frequency scale (optional, see page 398)**
8. **Status window:**
9. **Soft menu**



Controls marked with **R** are also available in freeze and cine replay.



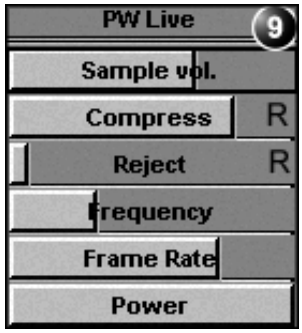
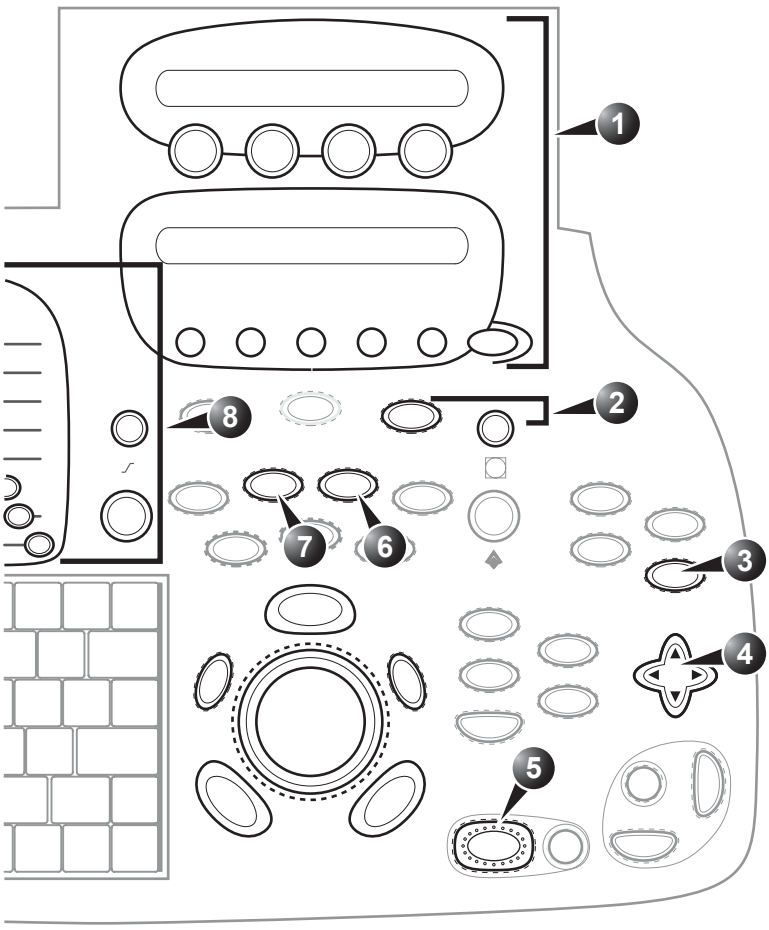


Figure 3-8: The PW/CW Doppler Mode screen



1. **Assignable keys:**
   - **Horizontal sweep R**
   - **Scale**
   - **Baseline R**
   - **LVR**
   - **Invert R**
   - **LPRF (in PW mode)**
   - **Color maps R**

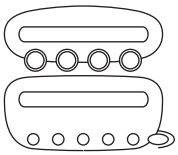
   MORE
   - **Quick angle**
   - **Angle correction**
2. **Zoom:**
   - **Display zoom**
   - **HR zoom**
3. **Img Size:**
   - **Small/large 2D display**
   - **Top/bottom display**
   - **Side by side display**
4. **Soft menu:**
   - **Sample Volume (PW)**
   - **Compress R**
   - **Reject R**
   - **Frequency**
   - **Frame rate**
   - **Angle Corr. R**
   - **Power**
5. **Freeze**
6. **CW**
7. **PW**
8. **Gain R**

Controls marked with ***R*** are also available in freeze and cine replay

Figure 3-9: The PW/CW controls on the front panel

PW and CW Doppler controls

PW and CW Doppler assignable controls



Horizontal sweep

Adjusts the horizontal refresh rate of the Doppler area of the display. Horizontal sweep is available in live and cine replay.

Scale

Adjusts the velocity scale to accommodate faster/slower blood flow velocities. Velocity scale determines pulse repetition frequency.

Baseline

Enables the Doppler baseline to be shifted up and down. The default Doppler baseline is set at the center of the vertical aspect of the Doppler display, dividing evenly the flow toward and away from the probe. By adjusting the baseline a larger portion of the analysis is assigned to the flow direction present. Baseline is available in live and cine replay.

Maximum velocity depends on sample volume size, sample volume position and frequency settings.

Velocity range

Enables the vertical scale of the Doppler spectrum and the maximal detectable velocity to be modified. Velocity range directly controls the pulse repetition frequency, which is responsible for the setting of the Nyquist limit (the ability to detect maximum velocity without aliasing).

Low velocity reject

Enables the low velocity portions of the spectrum to be filtered, since the Doppler spectrum and audio may contain strong wall-motion signals. The amount of Low Velocity Reject. is indicated by the green vertical bar at the right end of the baseline.

If the Doppler mode is combined with Color mode, the color map will be also inverted.

Invert

Enables the Doppler spectrum to be flipped 180 degrees, so that negative velocities are displayed above the baseline and positive velocities below the baseline. Invert is available in live and cine replay.

LPRF (PW mode)

Sets the pulse repetition frequency for the PW Doppler acquisition of flow data. Enables toggling between high and low Pulse Repetition Frequency (PRF). When the Doppler PRF is

raised beyond a certain limit, more than one Doppler gate is displayed on the screen.

Color maps

Displays a drop down menu of different Doppler colorization maps.Use the **trackball** to select the desired map and press **SELECT** to activate the map.

Quick angle and Angle correction

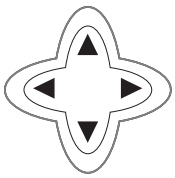
*In non-cardiac applications, **Angle correction** is controlled from the Trackball.*

Enables correction of the Doppler velocity scale by defining the angle between the Doppler beam and the investigated blood vessel or blood flow. A thin cross bar on the Doppler cursor will rotate as the control is adjusted. Angle correction is available in both Live and Freeze.

Quick angle adjusts the angle by 60 degrees.

Angle correction adjusts the angle between zero and 90 degrees with one degree increment.

PW/CW Doppler Soft menu controls



Sample volume

In PW mode, set the longitudinal size of the region to be sampled for measurement. Adjusting Sample volume may affect the PRF (Nyquist limit) settings. SV does not apply to CW mode, where the volume sampled is the full length of the area indicated by the cursor line.

Compress

Enables control over the contrast of the Doppler spectrum. When compression is raised, the spectrum image becomes softer and some low level background noise may appear. Compress is available in both Live and Freeze.

Reject

Enables undesirable background noise to be removed from the Doppler spectrum resulting in a darker background. Reject is available in both Live and Freeze.

Frequency

Adjusts the transmission frequency in Doppler to control sensitivity or level of penetration. The selected frequency is displayed in the status window. Adjusting Frequency may affect Sample Volume (PW) and LVR settings.

Frame rate

Adjusts the frame rate. The relative setting of the frame rate is displayed in the status window (under 2D).

Power

When power is reduced, it reduces the signal-to-noise ratio, so that the image may become noisier.

Controls the amount of acoustic power applied in all modes. When power is set to maximum, it is equal to or less than the maximum acoustic power permitted by the FDA. The Thermal Index (TI) and the Mechanical Index (MI) are displayed on the screen.

Using PW/CW Doppler modes

Controls and operations for PW and CW mode are the same unless otherwise noted.

There are two ways to start PW/CW Doppler:

Alternative 1:

1. Press **PW** or **CW**. A scanning screen is displayed with a Doppler cursor on the 2D mode image and a Doppler spectrum in the lower part of the screen.
2. Use the **trackball** to position the Doppler cursor line and in PW the sample volume location over the area of interest.

Sample Volume adjustment may affect the Scale, Frame rate and LV rej. settings.

3. In PW, with the **Soft menu rocker key**, adjust the sample Volume (SV):
   To enlarge the SV, press the **Right arrow** of the rocker
   To narrow the SV, press the **Left arrow** of the rocker.

Alternative 2:

1. Press **CURSOR** on the control panel. A cursor line is displayed on the 2D image.
2. With the **trackball** adjust the position of the cursor line.
3. Press **PW** or **CW**.

Optimizing PW/CW Doppler modes

Refer to page 400 about creating presets

The use of preset gives optimum performance with minimum adjustment. If necessary, the following controls can be adjusted to further optimize the PW/CW modes display:

- Adjust the **Active mode gain** to set the gain in the spectral Doppler area.
- Adjust **Low velocity reject** to reduce unwanted low velocity blood flow and tissue movement.
- In PW mode, adjust **Sample volume** to low setting for better resolution, or higher setting to more easily locate the disturbed flows.
- Adjust the **Compress** setting to balance the effect of stronger and weaker echoes and obtain the desired intensity display.

Frequency and Frame rate settings may affect the Low Velocity Reject.

- Adjust **Frequency** to optimize flow display. Higher setting will improve resolution and the lower setting will increase the depth penetration.
- Adjust **Frame rate** to a higher setting to improve motion detection, or to a lower setting to improve resolution.

The Doppler Power setting affects only Doppler operating modes.

- Adjust Power to obtain an acceptable image using the lowest setting possible. This is particularly important in CW mode, as the energy duty cycle is 100% (constant).

△
CAUTION

Use all noise reduction controls with care. Excessive application may obscure low level diagnostic information.

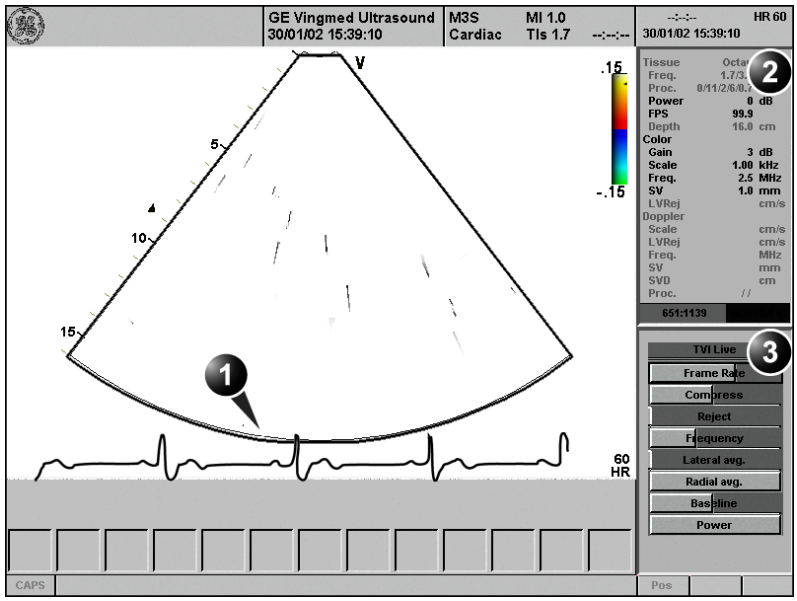
Adjust the following settings to further optimize the display of the image.

- Use the **Horizontal sweep** to optimize the sweep speed.
- To view signal detail, use the **Velocity range** to enlarge the vertical spectral Doppler trace.
- Use **Invert** to reverse the vertical component of the spectral Doppler area of the display.
- Use **Angle correction** to steer the ultrasound beam to the blood flow to be measured (Not typically required during cardiac studies).

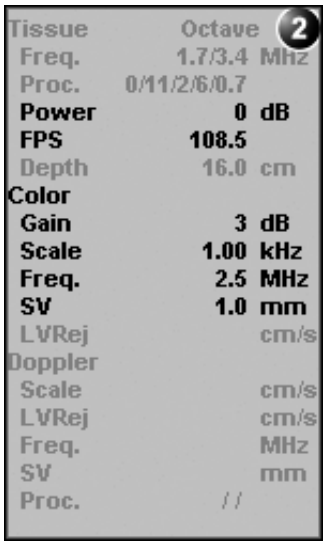
Tissue Velocity Imaging (TVI)

TVI overview

1. **Color sector marker**
2. **Status window:**
3. **Soft menu**



Controls marked with **R** are also available in freeze and cine replay.



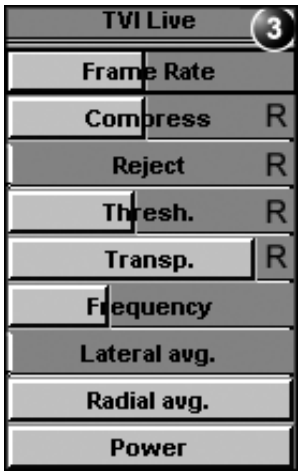
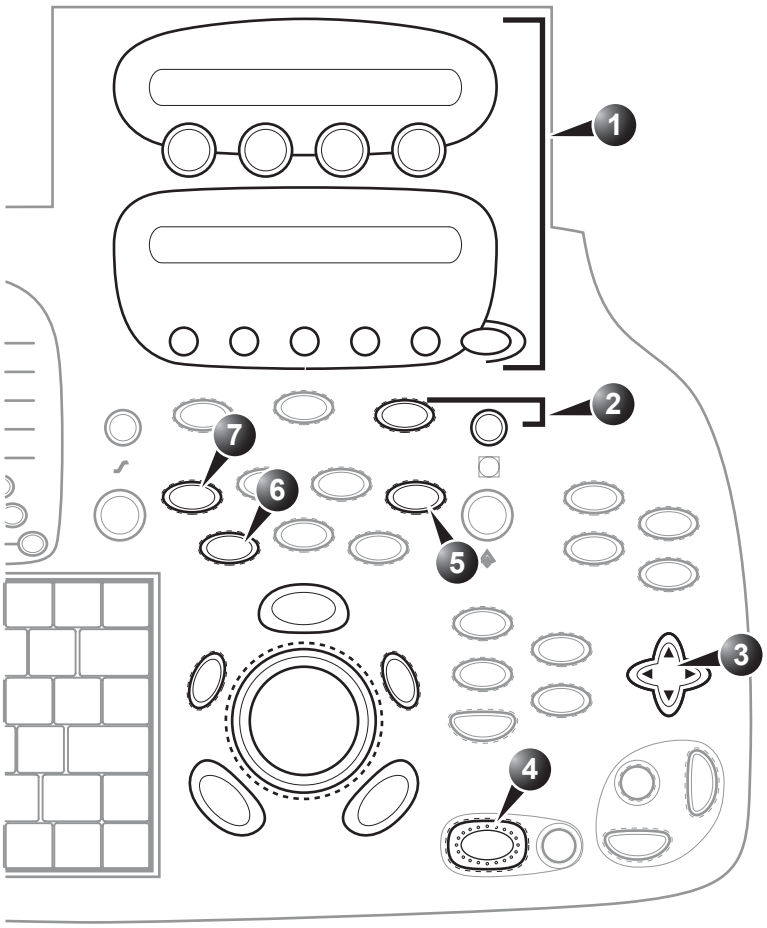


Figure 3-10: The TVI Mode screen



1. **Assignable keys:**
   - **2D Width**
   - **Scale**
   - **Baseline R**
   - **Invert R**
   - **Simultaneous R**
   - **Dual focus**
   - **Color maps**
   - **Cineloop (Freeze only)**
   - **Q-Analysis (Freeze only)**

   ALT
   - **Curved AMM R**
   - **AMM R**
   - **Tissue Tracking R**
   - **Strain rate R**
   - **Strain R**
2. **Zoom**
   - **Display zoom**
   - **HR zoom**
3. **Soft menu**
   - **Frame rate**
   - **Compress R**
   - **Reject**
   - **Frequency**
   - **Lateral avg.**
   - **Radial avg.**
   - **Baseline R**
   - **Power**
4. **Freeze**
5. **TVI**
6. **2D**
7. **Alternatives**

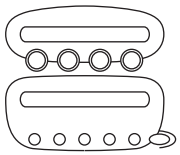
Controls marked with ***R*** are also available in freeze and cine replay

Figure 3-11: The TVI Mode controls on the front panel

Tissue Velocity Imaging (TVI) calculates and color-codes the velocities in tissue. The tissue velocity information is acquired by sampling of tissue Doppler velocity values at discrete points. The information is stored in a combined format with greyscale imaging during one or several cardiac cycles with high temporal resolution.

TVI controls

TVI assignable controls



2D width

Controls the angular width of the 2D image sector.

Lower scale value allows greater depth and lower Nyquist limit.

Scale

Adjusts the repetition rate of the Doppler pulses transmitted to acquire the data for color mapping.The Scale value influences the Nyquist limit (the ability to detect maximal velocity without color-aliasing).

Invert

Enables the color scheme assigned to positive and negative tissue velocities to be inverted. Invert is available in live and cine replay.

Simultaneous

Enables simultaneous display of 2D image and 2D image with TVI color.

Dual focus

Activates Dual focus mode. To adjust the Dual focus, press **ACT. MODE** and rotate the **FOCUS** assignable.

Cineloop (in Freeze only)

Starts cineloop acquisition.

Color maps

Displays a menu of color map options. Use the **trackball** to point a color map and press **SELECT** to activate a desired color map. Each color map is assigning different color hues to different velocities.

Q-analysis (in Freeze only)

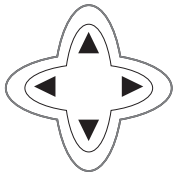
Starts the Quantitative analysis application (see Chapter 7, ’Quantitative Analysis’ on page 233).

Alternative assignable controls

Press **ALT** to access to the following modes:

- Curved Anatomical M-Mode (see page 98)
- Tissue Synchronization Imaging (see page 142)
- Tissue Tracking (see page 125)
- Strain rate (see page 130)
- Strain (see page 136)

TVI Soft menu controls



Frame rate

Controls the line density. When adjusting frame rate, there is a trade off between spatial and temporal resolution.

Compress

Controls the amount of color compression. The color bar is adjusted accordingly.

Reject (low velocity rejection)

Adjust the cut-off level for the low velocity of TVI to be discarded when generating the color image.

Threshold

Controls the level of greyscale intensity that is used as a threshold for color.

Transparency

Controls the degree of transparency of the TVI color.

Frequency

Enables the adjustment of the transmission frequency to control the sensitivity or the level of penetration.

Lateral Averaging

Use Averaging controls with caution so as not to obscure significant diagnostic information

Smooths the image by averaging collected data along the same horizontal line. An increase of the lateral averaging will reduce noise, but this will also reduce the lateral resolution.

Radial Averaging

Smooths the image by averaging collected data along the same radial line. An increase of the radial averaging will reduce noise, but this will also reduce the radial resolution.

Baseline

Adjusts the color map to emphasize tissue motion either toward or away from the probe. Baseline is available in both Live and Freeze.

When power is reduced, it reduces the signal-to-noise ratio, so that the image may appear noisier.

Power

Controls the amount of acoustic power applied in all modes. When power is set to maximum, it is equal to or less than the maximum acoustic power level permitted by regulatory standards. The Thermal Index (TI) and the Mechanical Index (MI) are displayed on the screen.

Using TVI

1. Select the desired probe.
2. While in 2D mode press **TVI** on the control panel.

Optimizing TVI

Refer to page 400 about creating presets.

The use of preset gives optimum performance with minimum adjustment. If necessary, the following controls can be adjusted to further optimize the TVI display:

The Scale value also affects the frame rate. There is a trade off between the frame rate and quantification noise.

- To reduce quantification noise (variance), the Nyquist limit should be as low as possible, without creating aliasing. To reduce the Nyquist limit: Reduce the **Scale** value from the assignables on the control panel.

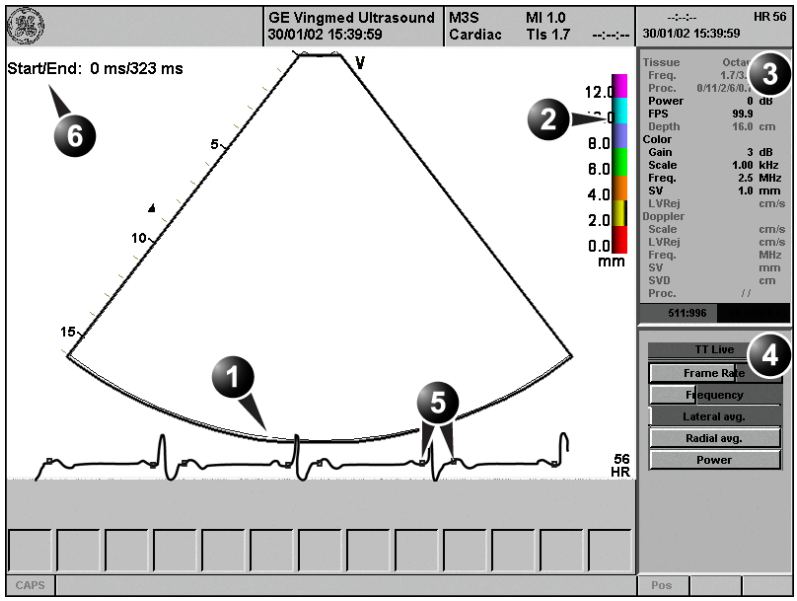
PW will be optimized for Tissue Velocities when activated from inside TVI.

- TVI provides velocity information only in the beam direction. The apical view typically provides the best window since the beams are then approximately aligned to the longitudinal direction of the myocardium (except near the apex). To obtain radial or circumferential tissue velocities, a parasternal view must be used. However, from this window the beam cannot be aligned to the muscle for all the parts of the ventricle.

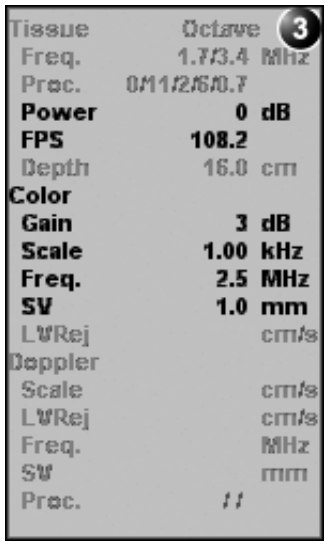
Tissue Tracking

Tissue Tracking overview

1. **Color sector marker**
2. **Tissue Tracking color bar**
3. **Status window**
4. **Soft menu**
5. **Track start and track end markers**
6. **Tracking start and end from R-peak**



Controls marked with **R** are also available in freeze and cine replay.



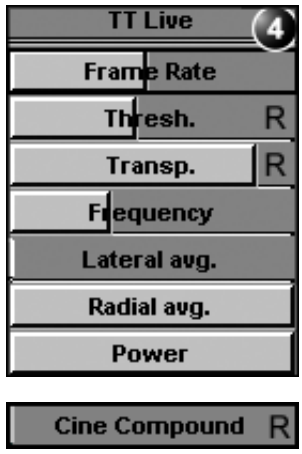
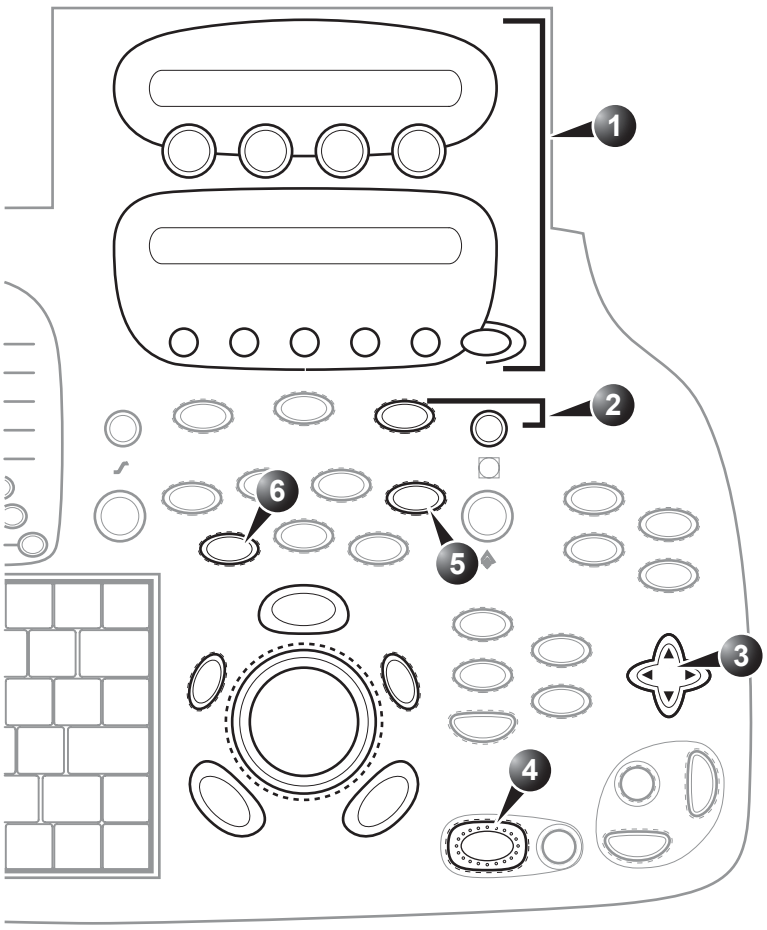


Figure 3-12: The Tissue Tracking Mode screen



1. **Assignable keys:**
   - **Track start R**
   - **Track end R**
   - **Track scale R**
   - **Invert R**
   - **Simultaneous R**
   - **Color maps R**
   - **Cineloop (Freeze only)**
   - **Q-Analysis (Freeze only)**

   MORE
   - **2D width**

   ALT
   - **Curved AMM R**
   - **AMM R**
   - **Tissue Tracking R**
   - **Strain rate R**
   - **Strain R**
2. **Zoom**
3. **Soft menu:**
   - **Frame rate**
   - **Transparency R**
   - **Threshold R**
   - **Frequency**
   - **Lateral avg.**
   - **Radial avg.**
   - **Power**
   - **Cine compound (Freeze only)**
4. **Freeze**
5. **TVI**
6. **2D**

Controls marked with ***R*** are also available in freeze and cine replay

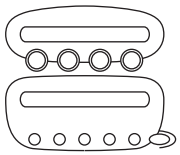
Figure 3-13: The Tissue Tracking controls on the front panel

Tissue Tracking calculates and color-codes the displacement in the tissue over a given time interval, typically the systole. The displacement is defined as the distance the tissue move during this time interval. The displacement is found as the time integral (sum) of the tissue velocities during this interval.

Only displacements in the beam direction are found. Only positive (systolic) displacements are mapped into colors, negative displacements are mapped into greyscale.

Tissue Tracking controls

Tissue Tracking assignable controls



Tracking start

The time after ECG R-peak when the integration should start.

Tracking end

The time after tracking start when the integration should end.

Tracking scale

Controls the color cut-off value of max displacement displayed. The chosen values is shown on the color bar when the assignable is activated.

Invert

Enables the color scheme assigned to positive and negative tissue velocities to be inverted. Invert is available in live and cine replay.

Simultaneous

Enables simultaneous display of 2D image and 2D image with Tissue Tracking color.

Cineloop (in Freeze only)

Starts cineloop acquisition.

Color maps

Displays a menu of color map options. Use the **trackball** to point a color map and press **SELECT** to activate a desired color map.

Q-analysis (in Freeze only)

Starts the Quantitative analysis application (see Chapter 7, ’Quantitative Analysis’ on page 233).

2D width (More menu)

Controls the angular width of the 2D image sector.

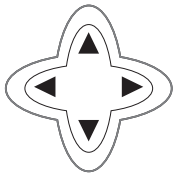
Alternative assignable controls

Press **ALT** to access to the following modes:

- Curved Anatomical M-Mode (see page 98)
- Tissue Synchronization Imaging (see page 142)

- Tissue Tracking (see page 125)
- Strain rate (see page 130)
- Strain (see page 136)

Tissue Tracking Soft menu controls



Frame rate

Controls the line density. When adjusting frame rate, there is a trade off between spatial and temporal resolution.

Transparency

Controls the degree of transparency of the Tissue Tracking color.

Threshold

Controls the level of greyscale intensity that is used as a threshold for color.

Frequency

Enables the adjustment of the transmission frequency to control the sensitivity or the level of penetration.

Use Averaging controls with caution so as not to obscure significant diagnostic information

Lateral Averaging

Smooths the image by averaging collected data along the same horizontal line. An increase of the lateral averaging will reduce noise, but this will also reduce the lateral resolution.

Radial Averaging

Smooths the image by averaging collected data along the same radial line. An increase of the radial averaging will reduce noise, but this will also reduce the radial resolution.

Power

Controls the amount of acoustic power applied. When power is reduced the signal to noise ratio is reduced, so that the image may become noisier.

Cine Compound (Freeze only)

Calculates and displays cineloops generated from a temporal averaging of multiple consecutive heart cycles. The number of cycles averaged is controlled from the Soft menu rocker. The number of averaged cycles i displayed on the top left corner.

Using Tissue Tracking

1. From TVI Mode, press **ALT** on the control panel and press the **TISSUE TRACKING** assignable.
2. Adjust **TRACKING START** (assignable) close to the R-peak.
3. Adjust **TRACKING END** (assignable) near the T-wave.

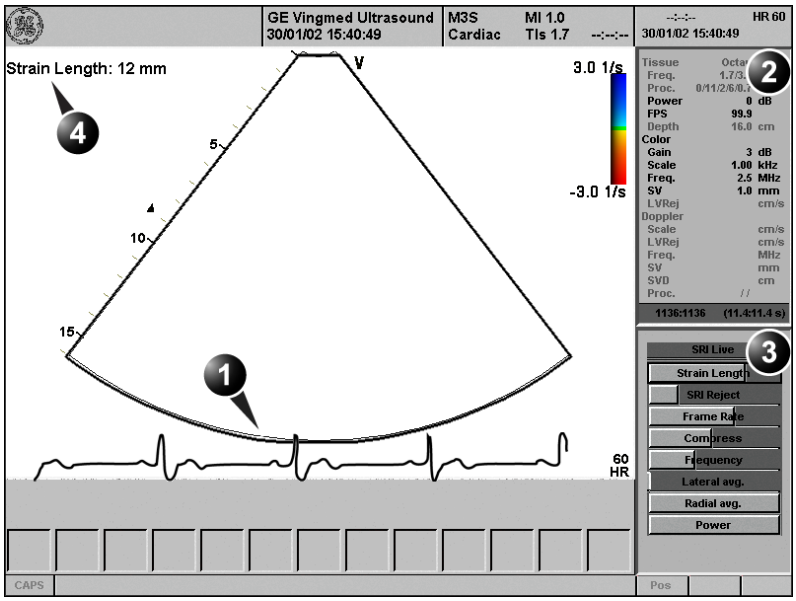
Optimizing Tissue Tracking

- To reduce quantification noise (variance), the Nyquist limit should be as low as possible, without creating aliasing. To reduce the Nyquist limit, reduce the scale while in TVI.
- To check for aliasing, freeze the loop and apply velocity trace (Press **FREEZE** and **Q-ANALYSIS**), see also Chapter 7, ’Quantitative Analysis’ on page 233).
- The main use of Tissue Tracking is to map positive systolic displacements. This means that **TRACKING START** and **TRACKING END** assignables should be adjusted to pick out the systolic phase of the cardiac cycle: Adjust **Tracking start** close to the R-Peak. Adjust **Tracking end** near the T-wave.
- Negative displacement can be mapped by pressing **INVERT**. **TRACKING START** and **TRACKING END** must then be adjusted to pick out the diastolic phase of the cardiac cycle.
- The maximum displacement that is color-coded can be adjusted using the **TRACKING SCALE** assignable. If set too low, most of the wall will show the color indicating maximum displacement. If set too high, the maximum displacement color is never reached.
- Tissue Tracking provides velocity information only in the beam direction. The apical view typically provides the best window since the beams are then approximately aligned to the longitudinal direction of the myocardium (except near the apex).

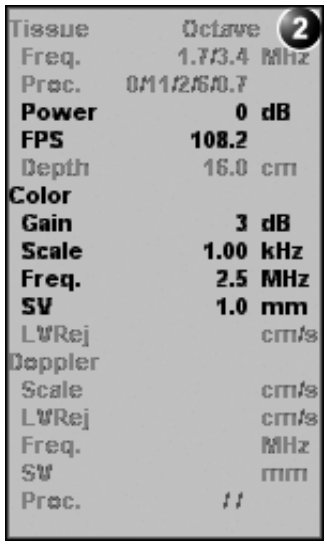
Strain rate

Strain rate overview

1. **Color sector marker**
2. **Status window**
3. **Soft menu**
4. **Strain sample size**



Controls marked with R are also available in freeze and cine replay.



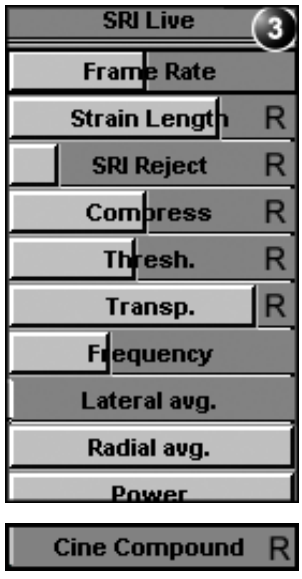
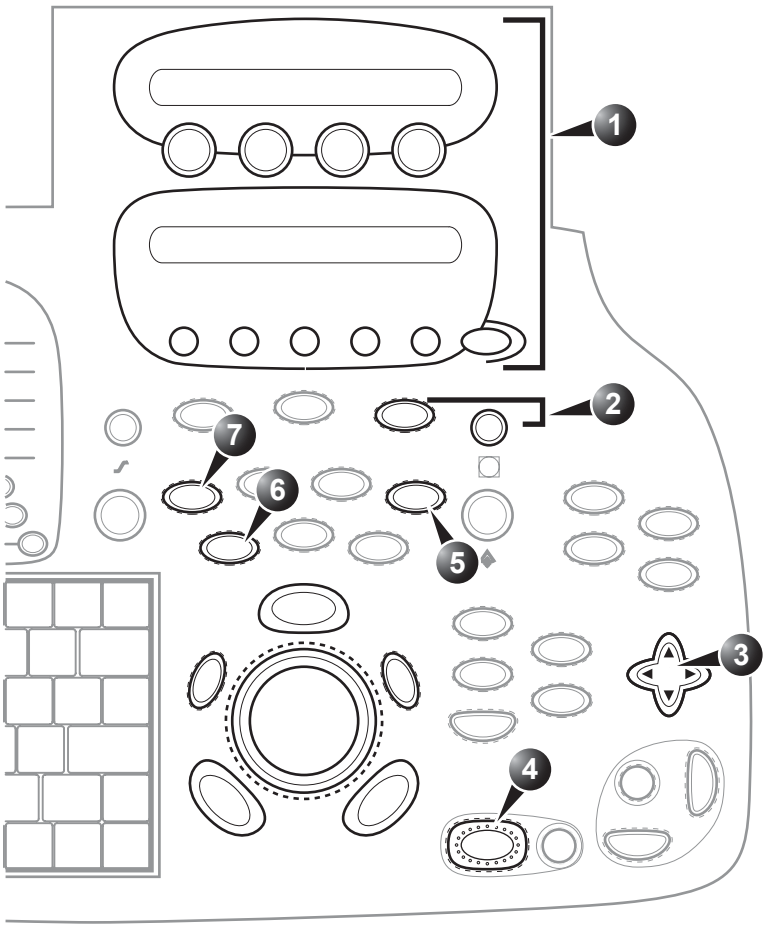


Figure 3-14: The Strain rate mode screen



1. **Assignable keys:**
   - **2D width**
   - **SRI scale R**
   - **Invert R**
   - **Simultaneous R**
   - **Color maps R**
   - **Q-Analysis (Freeze only)**
   - **Cineloop (Freeze only)**

   ALT
   - **Curved AMM R**
   - **AMM R**
   - **Tissue Tracking R**
   - **Strain rate R**
   - **Strain R**
2. **Zoom**
   - **Display zoom**
   - **HR zoom**
3. **Soft menu:**
   - **Frame rate**
   - **Strain Length**
   - **SRI Reject R**
   - **Compress R**
   - **Transparency R**
   - **Threshold R**
   - **Frequency**
   - **Lateral avg.**
   - **Radial avg.**
   - **Power**
   - **Cine compound R (Freeze only)**
4. **Freeze**
5. **TVI**
6. **2D**

Controls marked with R are also available in freeze and cine replay

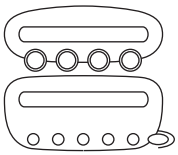
Figure 3-15: The Strain rate mode controls on the front panel

Strain rate calculates and color-codes the deformation per unit time i.e the speed at which the tissue deformation occurs.

Strain rate is defined as the spatial gradient of velocity data.

Strain rate controls

Strain rate assignable controls



2D width

Controls the angular width of the 2D image sector.

SRI scale

Defines the scale for the color coding of the strain rate.

Invert

Enables the color scheme assigned to strain rate to be inverted. Invert is available in live and cine replay.

Simultaneous

Enables simultaneous display of 2D image and 2D image with Strain rate color.

Color maps

Displays a menu of color map options. Use the **trackball** to point a color map and press **SELECT** to activate a desired color map.

Q-analysis (in Freeze only)

Starts the Quantitative analysis application (see Chapter 7, ’Quantitative Analysis’ on page 233).

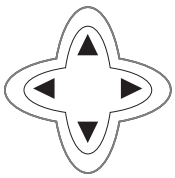
Cineloop (in Freeze only)

Starts cineloop acquisition.

Alternative assignable controls

Press **ALT** to access to the following modes:

- Curved Anatomical M-Mode (see page 98)
- Tissue Synchronization Imaging (see page 142)
- Tissue Tracking (see page 125)
- Strain rate (see page 130)
- Strain (see page 136)



Strain rate Soft menu controls

Frame rate

Controls the line density. When adjusting frame rate, there is a trade off between spatial and temporal resolution.

Strain length

Determines the strain sample volume size.

SRI Reject

Adjust the cut-off level of the low tissue velocity to be discarded when generating the color image. Rejected values are displayed in green.

Compress

Controls the amount of color compression. The color bar is adjusted accordingly.

Transparency

Control the degree of transparency of the strain rate color.

Threshold

Controls the level of greyscale intensity that is used as threshold for color.

Frequency

Enables the adjustment of the transmission frequency to control the sensitivity or the level of penetration.

Lateral Averaging

Smooths the image by averaging collected data along the same horizontal line. An increase of the lateral averaging will reduce noise, but this will also reduce the lateral resolution.

Use Averaging controls with caution so as not to obscure significant diagnostic information.

Radial Averaging

Smooths the image by averaging collected data along the same radial line. An increase of the radial averaging will reduce noise, but this will also reduce the radial resolution.

Power

Controls the amount of acoustic power applied. When power is reduced the signal to noise ratio is reduced, so that the image may become noisier.

Cine Compound (Freeze only)

Calculates and displays cineloops generated from a temporal averaging of multiple consecutive heart cycles. The number of cycles averaged is controlled from the Soft menu rocker. The number of averaged cycles i displayed on the top left corner.

Using Strain rate

1. From TVI Mode, press **ALT** on the control panel and press **STRAIN RATE**.

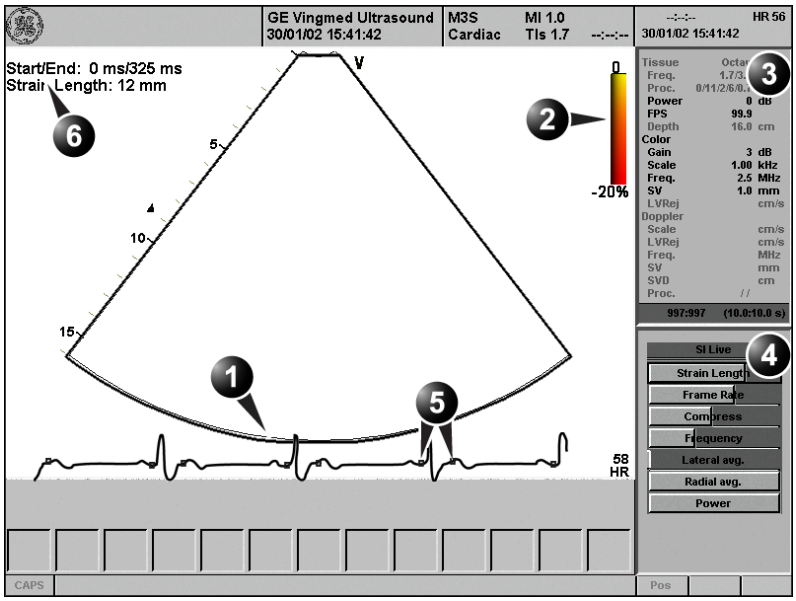
Optimizing Strain rate

- To reduce quantification noise (variance), the Nyquist limit should be as low as possible, without creating aliasing. To reduce the Nyquist limit, reduce the scale while in TVI.
- To check for aliasing, freeze the loop and apply velocity trace (Press **FREEZE** and **Q-ANALYSIS**), see also Chapter 7, ’Quantitative Analysis’ on page 233).
- Strain rate provides velocity information only in the beam direction. The apical view typically provides the best window since the beams are then approximately aligned to the longitudinal direction of the myocardium (except near the apex).
- There is a trade-off between noise and spatial resolution controlled by the **Strain length**. To minimize noise the **Strain length** should be maximized.
- The maximum Strain rate that is color-coded can be adjusted using the **SRI SCALE** assignable. If set too low, most of the wall will show the color indicating maximum Strain rate. If set too high, the maximum Strain rate color is never reached.

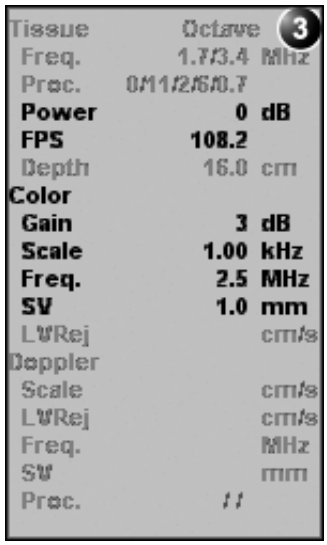
Strain

Strain overview

1. **Color sector marker**
2. **Strain color bar**
3. **Status window**
4. **Soft menu**
5. **Strain start and end markers**
6. **Strain start and end from R-peak and Strain sample size**



Controls marked with R are also available in freeze and cine replay.



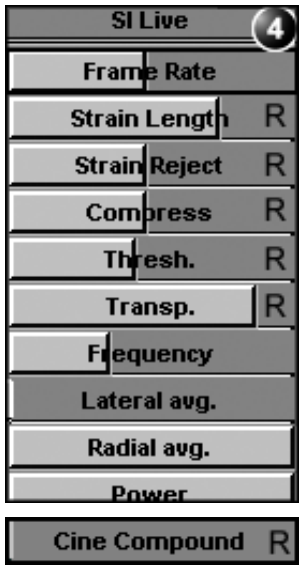
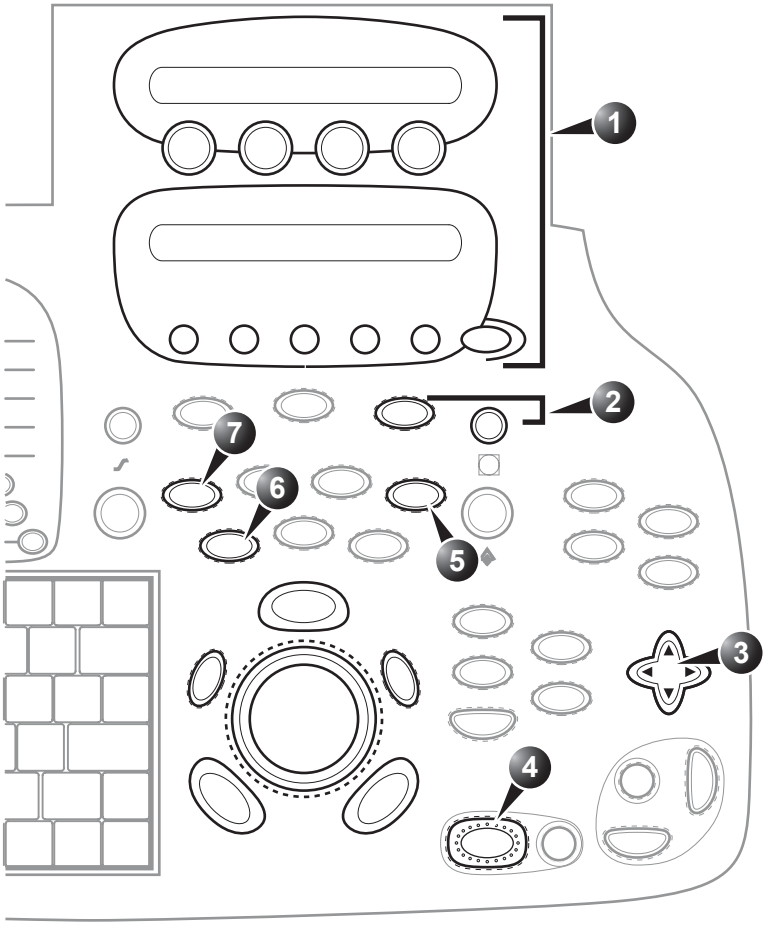


Figure 3-16: The Strain mode screen



1. **Assignable keys:**
   - **Strain start R**
   - **Strain end R**
   - **Strain scale R**
   - **Invert R**
   - **Simultaneous R**
   - **Color maps R**
   - **Q-Analysis (Freeze only)**
   - **Cineloop (Freeze only)**

   MORE
   - **2D width**

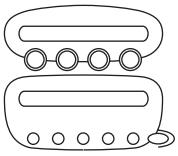
   ALT
   - **Curved AMM R**
   - **AMM R**
   - **Tissue Tracking R**
   - **Strain rate R**
   - **Strain R**
2. **Zoom**
   - **Display zoom**
   - **HR zoom**
3. **Soft menu:**
   - **Frame rate**
   - **Strain Length R**
   - **Strain Reject R**
   - **Compress R**
   - **Transparency R**
   - **Threshold R**
   - **Frequency**
   - **Lateral avg.**
   - **Radial avg.**
   - **Power**
   - **Cine compound R (Freeze only)**
4. **Freeze**
5. **TVI**
6. **2D**

Controls marked with R are also available in freeze and cine replay

Figure 3-17: The Strain Mode controls on the front panel

Strain calculates and color-codes the extent of tissue deformation (lengthening or shortening) relative to the original size over a given time interval, typically the systole.

Strain controls



Strain assignable controls

Strain start

The time after ECG R-peak when the strain calculation should start. The strain start time is displayed on the screen and is represented on the ECG by a red marker.

Strain end

The time after strain start when the strain calculation should end. The strain end time is displayed on the screen and is represented on the ECG by a red marker.

Strain scale

Defines the scale for the color coding of the tissue deformation.

Invert

Enables the color scheme assigned to shortening and elongation tissue deformation to be inverted. Invert is available in live and cine replay.

Simultaneous

Enables simultaneous display of 2D image and 2D image with Strain color.

Color maps

Displays a menu of color map options. Use the **trackball** to point a color map and press **SELECT** to activate a desired color map.

Q-analysis (in Freeze only)

Starts the Quantitative analysis application (see Chapter 7, 'Quantitative Analysis' on page 233).

Cineloop (in Freeze only)

Starts cineloop acquisition.

2D width (More menu)

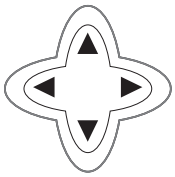
Controls the angular width of the 2D image sector.

Alternative assignable controls

Press **ALT** to access to the following modes:

- Curved Anatomical M-Mode (see page 98)
- Tissue Synchronization Imaging (see page 142)
- Tissue Tracking (see page 125)
- Strain rate (see page 130)
- Strain (see page 136)

Strain Soft menu controls



Frame rate

Controls the line density. When adjusting frame rate, there is a trade off between spatial and temporal resolution.

Strain length

Determines the strain sample volume size.

Strain Reject

Adjust the cut-off level of the low tissue velocity to be discarded when generating the color image. Rejected values are uncolored.

Compress

Controls the amount of color compression. The color bar is adjusted accordingly.

Transparency

Control the degree of transparency of the strain color.

Threshold

Controls the level of greyscale intensity that is used as threshold for color.

Frequency

Enables the adjustment of the transmission frequency to control the sensitivity or the level of penetration.

Lateral Averaging

Smooths the image by averaging collected data along the same horizontal line. An increase of the lateral averaging will reduce noise, but this will also reduce the lateral resolution.

Use Averaging controls with caution so as not to obscure significant diagnostic information.

Radial Averaging

Smooths the image by averaging collected data along the same radial line. An increase of the radial averaging will reduce noise, but this will also reduce the radial resolution.

Power

Controls the amount of acoustic power applied. When power is reduced the signal to noise ratio is reduced, so that the image may become noisier.

Cine Compound (Freeze only)

Calculates and displays cineloops generated from a temporal averaging of multiple consecutive heart cycles. The number of cycles averaged is controlled from the Soft menu rocker. The number of averaged cycles i displayed on the top left corner.

Using Strain

1. From TVI Mode, press **ALT** on the control panel and press **STRAIN**.
2. Adjust **STRAIN START** close to the R-peak.
3. Adjust **STRAIN END** near the T-wave.

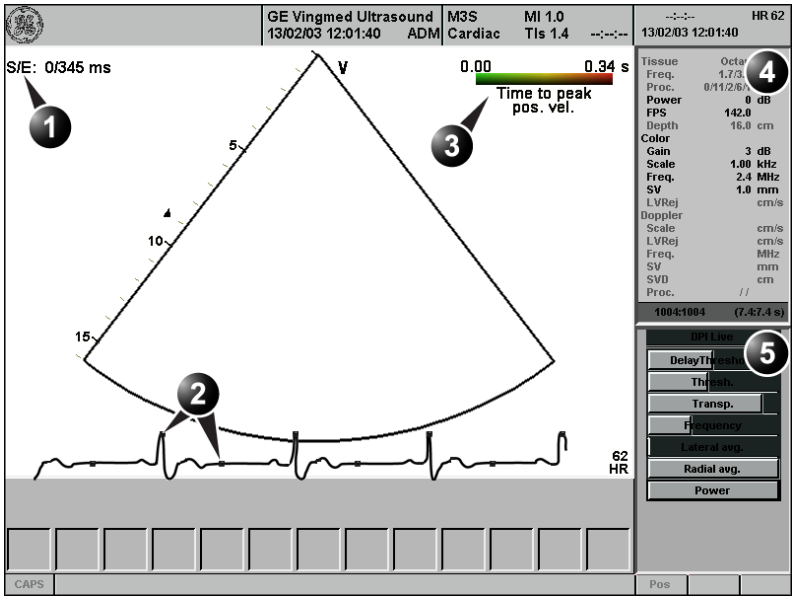
Optimizing Strain

- From an optimized Strain rate display adjust strain tracking to pick out the systolic phase.
- The main use of Strain is to map negative systolic deformation. This means that **STRAIN START** and **STRAIN END** should be adjusted to pick out the systolic phase of the cardiac cycle: Adjust **STRAIN START** close to the R-Peak. Adjust **STRAIN END** near the T-wave.
- Positive deformation can be mapped by pressing **INVERT**. **STRAIN START** and **STRAIN END** must then be adjusted to pick out the diastolic phase of the cardiac cycle.
- The maximum deformation that is color-coded can be adjusted using the **STRAIN SCALE** assignable. If set too low, most of the wall will show the color indicating maximum deformation. If set too high, the maximum deformation color is never reached.
- Strain provides velocity information only in the beam direction. The apical view typically provides the best window since the beams are then approximately aligned to the longitudinal direction of the myocardium (except near the apex).

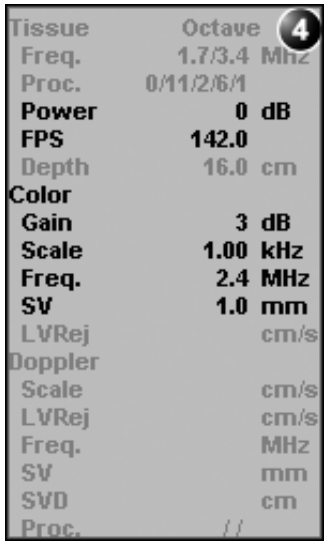
Tissue Synchronization Imaging (TSI)

TSI overview

1. **TSI start/end**
2. **TSI start and end markers**
3. **TSI color bar**
4. **Status window**
5. **Soft menu**



Controls marked with R are also available in freeze and cine replay.



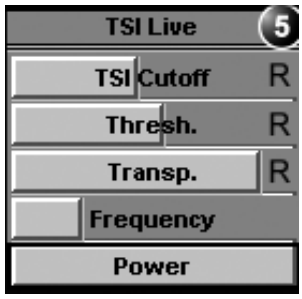
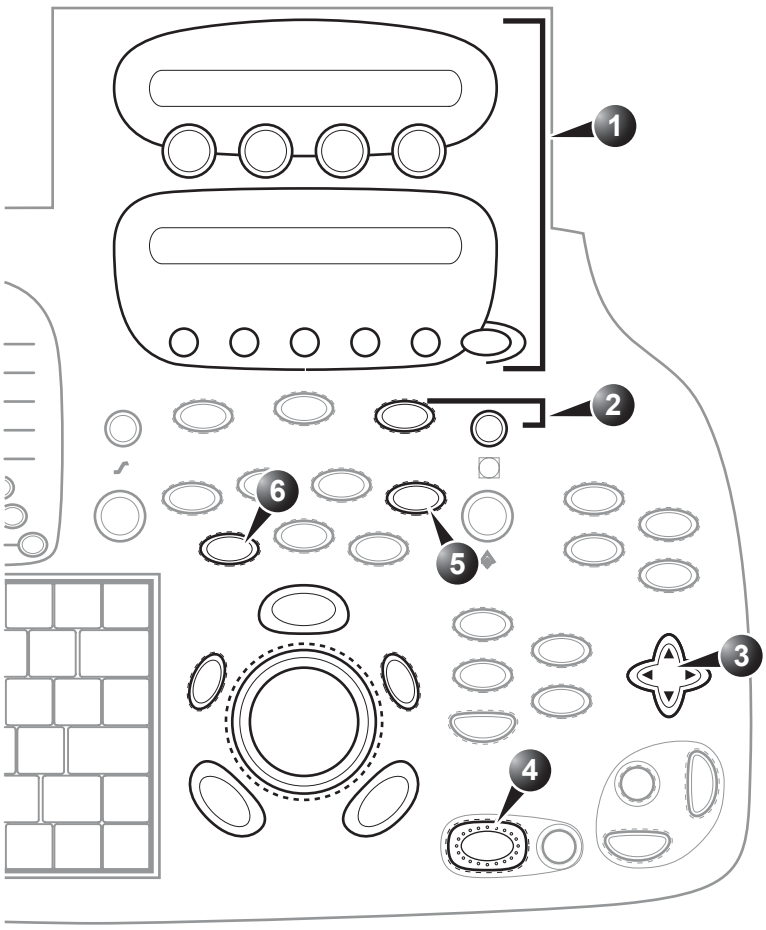


Figure 3-18: The TSI mode screen



1. **Assignable keys:**
   - **Frame rate**
   - **TSI R**
   - **Simultaneous R**
   - **Color maps R**
   - **Cineloop (Freeze only)**
   - **Q-Analysis (Freeze only)**

   MORE
   - **2D width**
   - **TSI start R**
   - **TSI end R**

   ALT
   - **Curved AMM R**
   - **AMM R**
   - **Tissue Tracking R**
   - **Strain rate R**
   - **Strain R**
2. **Zoom**
3. **Soft menu:**
   - **TSI Cut-off R**
   - **Threshold R**
   - **Transparency R**
   - **Frequency**
   - **Power**
   - **Cine compound (Freeze only)**
4. **Freeze**
5. **TVI**
6. **2D**

Controls marked with ***R*** are also available in freeze and cine replay

Figure 3-19: The TSI mode controls on the front panel

TSI calculates and color-codes the time from onset of QRS to a detected event, typically the time to peak systolic velocity.

TSI controls

TSI assignable controls

Frame rate

Controls the line density. When adjusting frame rate, there is a trade off between spatial and temporal resolution.

TSI

Starts/stops TSI.

Q-analysis (in Freeze only)

Starts the Quantitative analysis application (see Chapter 7, 'Quantitative Analysis' on page 233).

Simultaneous

Enables simultaneous display of 2D image and 2D image with TSI color.

Cineloop (in Freeze only)

Starts cineloop acquisition.

Color maps

Displays a menu of color map options. Use the **trackball** to point a color map and press **SELECT** to activate a desired color map.

TSI start

The time from the onset of QRS when TSI starts, indicated by a red marker on the ECG. The default value is set to approximate the time for start ejection and by the value on the left side of the color bar.

Press **MORE** to access this control.

TSI end

The time after TSI start when TSI ends, indicated by a red marker on the ECG. The default value is set to approximate the aortic valve closure and by the value on the right side of the color bar.

Press **MORE** to access this control.

Alternative assignable controls

Press ALT to access to the following modes:

- Curved Anatomical M-Mode (see page 98)
- Tissue Synchronization Imaging (see page 142)
- Tissue Tracking (see page 125)
- Strain rate (see page 130)
- Strain (see page 136)

TSI Soft menu controls

TSI Cut-off

Controls the cut-off time: using this control it is possible to color all parts of the TSI image that has a time to peak less than a certain cutoff time.

Threshold

Controls the level of greyscale intensity that is used as threshold for color.

Transparency

Control the degree of transparency of the strain color.

Frequency

Enables the adjustment of the transmission frequency to control the sensitivity or the level of penetration.

Power

Controls the amount of acoustic power applied. When power is reduced the signal to noise ratio is reduced, so that the image may become noisier.

Cine Compound (Freeze only)

Calculates and displays cineloops generated from a temporal averaging of multiple consecutive heart cycles. The number of cycles averaged is controlled from the Soft menu rocker. The number of averaged cycles i displayed on the top left corner.

Using TSI

1. From TVI, Tissue Tracking, Strain or Strain rate mode, select **TSI**.
2. Press **MORE** and adjust **TSI START** and **TSI END**.
3. Optionally adjust **THRESHOLD**.

Optimizing TSI

- Use apical view when imaging.
- Activate TSI from an optimized TVI or Strain rate display.
- To detect regions with post-systolic contraction, adjust **TSI START** to start ejection to avoid detecting IVC peaks and **TSI END** to mitral valve opening or later. Regions with post-systolic contraction will show up in red.
- To detect asynchronous regions, adjust **TSI START** to start ejection to avoid detecting IVC peaks and **TSI END** to aortic valve closure. Regions colored in red have delayed peak velocity compared to regions colored in green.

Chapter 4
Stress Echo

This chapter includes the following information:

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- **Selection of a stress test protocol template 149**
- **Image acquisition 150**
  - Starting acquisition 151
  - Continuous capture mode 155
- **Analysis 163**
  - Image selection for analysis 163
  - Scoring acquired loops 165
- **Quantitative TVI Stress echo analysis 169**
  - Accessing QTVI Stress analysis tools 171
  - Vpeak measurement 171
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- **Editing/creating a template 177**
  - Entering the Template editor screen 177
  - Template editor screen overview 178
  - Editing/Creating a template 181

Introduction

The Vivid 7/Vivid 7 PRO ultrasound unit provides an integrated stress echo package, with the ability to perform image acquisition, review, image optimization, and wall segment scoring and reporting for a complete, efficient stress echo examination.

The stress package provides protocol templates for exercise, as well as, pharmacological stress examinations. In addition to preset factory protocol templates, templates can be created or modified to suit users' needs. Users can define various quad screen review groups, in any order and combination, that will suit their normal review protocol. When reviewing stress examination images, the images are viewed at their original image quality, and different post-processing and zoom factors may be applied to the images under review for effective image optimization. The protocol template may be configured for Continuous capture. In addition to standard wall motion scoring analysis, the user can perform quantitative stress analysis based on tissue velocity information (TVI).

A stress echo examination consists of three steps:

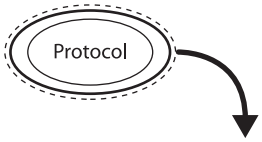
- Selection of a stress test protocol template (page 149)
- Image acquisition (page 150)
- Stress analysis (page 163)
- Quantitative Stress analysis (page 169)

Selection of a stress test protocol template

1. Press **PROTOCOL** to enter the stress echo mode.
   The *Protocol screen* is displayed (see Figure 4-1) showing the default stress protocol for the current probe.

To create or edit a template see page 177.

2. •To use the current template:
   Turn freeze off to initiate scanning.
   •To use another template:
   Press the assignable **TEMPLATE**.
   The template list is displayed.
3. Trackball to the desired template.
4. Press **SELECT**.
5. Turn freeze off to initiate scanning using the new template.



1. **Projection selection**
2. **Level**
3. **Current acquisition**
4. **Projection**
5. **Group of views**

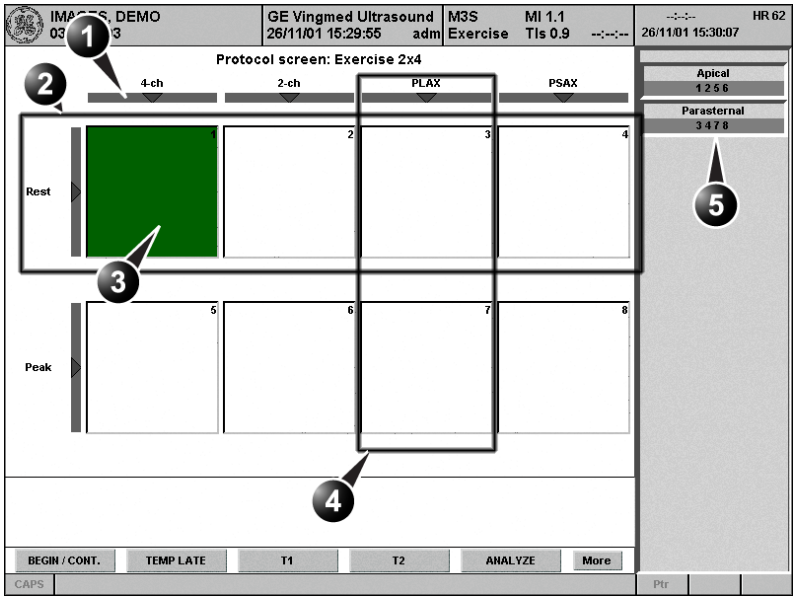


Figure 4-1: The Protocol screen

Image acquisition

Images are acquired in a pre-defined order, according to the selected template. The highlighted cell (green) of the matrix, displayed in the *Clipboard window* indicates which view is currently being acquired (see Figure 4-2). The names of both the view and the level for the current cell is displayed on the top corner of the image area and under the template matrix.

1. **Current view label**
2. **Template matrix**
3. **Current view (Green cell)**
4. **Timers**

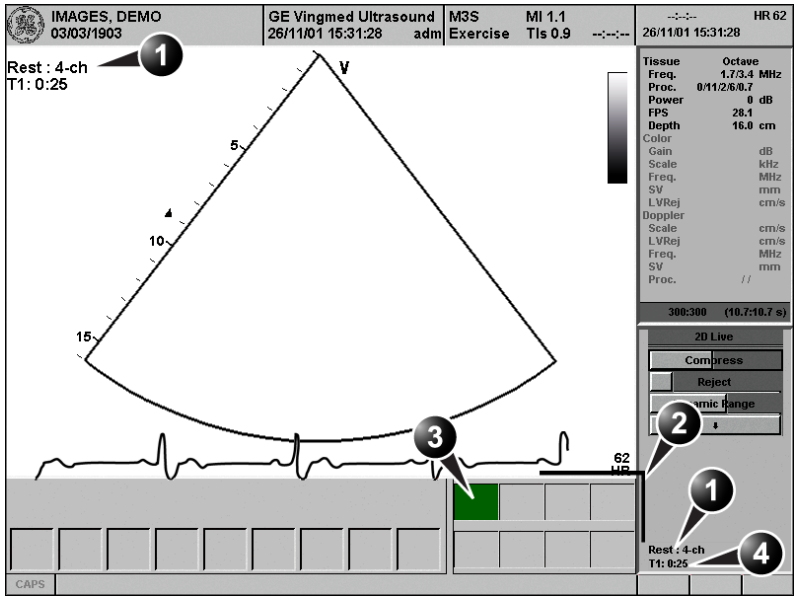


Figure 4-2: The stress mode acquisition screen

Starting acquisition

To use the Timer, see page 154.

1. Turn freeze off to initiate scanning.
2. Perform a scan that conforms with the view that is highlighted in the template matrix on the *Clipboard window*.

   Smart Stress is turned on by default in factory templates.

   If the selected template has the option **Smart Stress** turned on (see page 180), a subset of the image acquisition settings for each view in the baseline level will be stored and automatically reused in the corresponding views in the next levels.
3. Press **STORE**.

   For further information on stress test configuration, see page 177.

   - If the actual stress level is configured to preview cineloop before storing, use the cineloop controls to select the most appropriate heart cycle and, if desired adjust the loop markers (see 'Cineloop operation' on page 62 for further information). Press **STORE** to save the selected cineloop.
   - If the actual stress level is not configured to preview cineloop before storing, the system will automatically store the last cardiac cycle.

   When storage of the cineloop is completed, the actual highlighted cell in the template matrix displays a 2D icon indicating that the view has been acquired. After storing the loop, the system automatically highlights the next view in the matrix to be acquired.

   For further information on stress test configuration, see page 177.

   Stress levels can be configured for side by side display/ comparison of the reference loop from baseline or previous level and the loop to acquire (see Figure 4-3).
4. Repeat previous steps until all required views are completed.

△
CAUTION

If using DICOM Server dataflow for stress-echo acquisition, images should not be saved to permanent archive before the complete protocol exam is acquired.

The template used can be configured so that analysis is automatically started, displaying the first protocol group. The wall segment scoring diagrams for each view is displayed in the *Parameters window* on the right side of the screen (see Figure 4-9, page 165).

1. **Current acquisition loop**
2. **Corresponding reference loop**

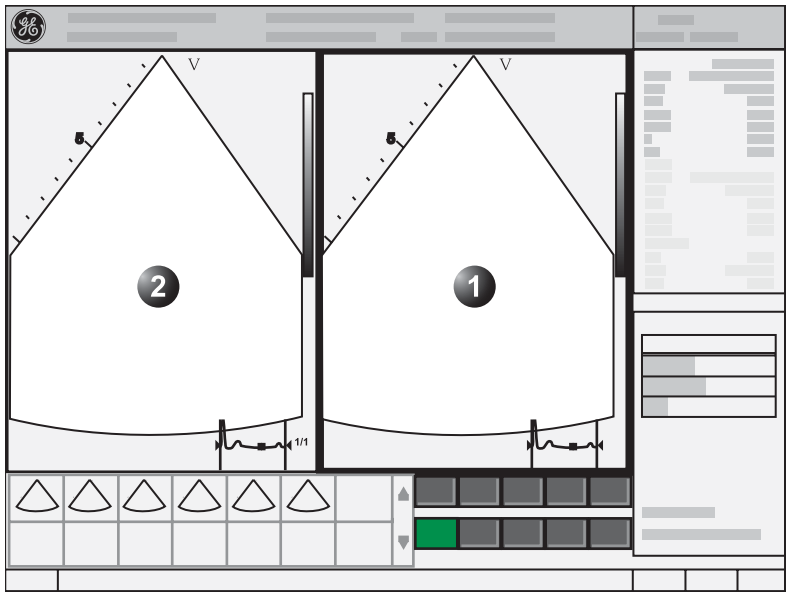


Figure 4-3: Display of the Reference loop during acquisition

Selecting a view during acquisition

A fixed protocol is provided for scanning, based on the selected template. The system automatically highlights the next view to be acquired in the template matrix, as images are stored. However, the order of scanning may be changed manually as follow:

Manual selection of a view during acquisition

1. Use the **arrow keys** on the alphanumeric keyboard to highlight the cell that represents the view that is to be acquired.
   The selected cell in the template matrix is highlighted in red, indicating non-default position and is blinking if it contains a previously stored acquisition.
2. Turn freeze off to initiate scanning.
3. Scan and save the selected loop as explained in the previous section.

After storage the system automatically highlights the next available view to be acquired.

Replacing an acquired image

1. Use the **arrow keys** on the alphanumeric keyboard to highlight the cell that represents the view that is to be replaced.
   The selected cell in the template matrix is highlighted in red, indicating non-default position.
2. Turn freeze off to initiate scanning.
3. Scan and save the selected loop as explained in the previous section.

After storage the system automatically highlights the next available view to be acquired.

Moving an acquired image

An Image can be moved from one cell to another during acquisition. There are two ways to move images:

Procedure 1

1. When in the *Protocol screen*, press **MORE** (assignable menu).
2. Press the assignable **MOVE IMAGES**.
3. Trackball to the image to move (source cell).
4. Press **SELECT**.
5. Trackball to the destination cell.
6. Press **SELECT**.
   The image is moved from the souce cell to the destination cell.

Procedure 2

1. In the *Protocol screen*, trackball to the cell containing the image to move (source cell).
2. Press and hold down **SELECT**.
3. With the **SELECT** key still depressed, trackball to the destination cell.
4. Release the **SELECT** key.
   The image is moved from the source cell to the destination cell.

Stored images cannot be moved.

If the destination cell contains an image, the images from the source and destination cells will be exchanged when moving an acquired image.

Blood Pressure and heart rate data

The blood pressure (systolic and diastolic) and heart rate can be manually entered during acquisition (or during Wall motion analysis).

1. Press **MEASURE**.
   The *Measurement menu* is displayed.
2. Select **Wall Motion**.
   The systolic and diastolic blood pressure and the heart rate for the active cell stress-level are displayed on the button over the scoring diagrams (see Figure 4-9, page 165). By pressing this button it is possible to enter blood pressure and heart rate values for all stress levels.

Timers

Two timers can be displayed in the *Stress mode acquisition screen*, beside the template matrix (see Figure 4-4).

1. Timers display

Figure 4-4: The timers in the acquisition screen

- **T1** displays the elapsed time from the start of the stress examination.
- **T2** starts when entering live scanning on the second stress level

Both T1 and T2 timers can be manually stopped and restarted during the acquisition from the *System Menu* (Press **MENU** on the control panel).

The display of T1 and T2 is user-configurable (see page 177).

Continuous capture mode

Continuous capture mode enables the user to perform acquisition continuously for all views at any level depending on the selected template configuration. Continuous capture consists of temporary saving images acquired in a storage buffer. To enable best possible use of the limited storage buffer capacity, a Pause/Capture mode is provided, as opposed to the normal Freeze/Scan mode. The Pause mode enables scanning and live display on the screen, without any capture, thereby leaving the buffer available.

To run Continuous capture, the user has to select a template where this feature is activated (see page 177 about template configuration).

The buffer bar

When entering a level with Continuous capture enabled, a *Buffer bar* is displayed in the *Info window* (see Figure 4-5). The *Buffer bar* displays the following information:

- The unit's scanning state:
  - **PAUSE** (live scanning without storing)
  - **CAPTURE** (live scanning with storing to buffer)
- The percentage of the buffer that is filled
- The buffer filling progression showed by a green filling gauge
- The capturing sessions, reflected by the red lines along the Buffer bar

1. **Scanner's state:**
2. **Capture session**
3. **Pause session**
4. **Buffer gauge**
5. **Percentage of filled buffer**

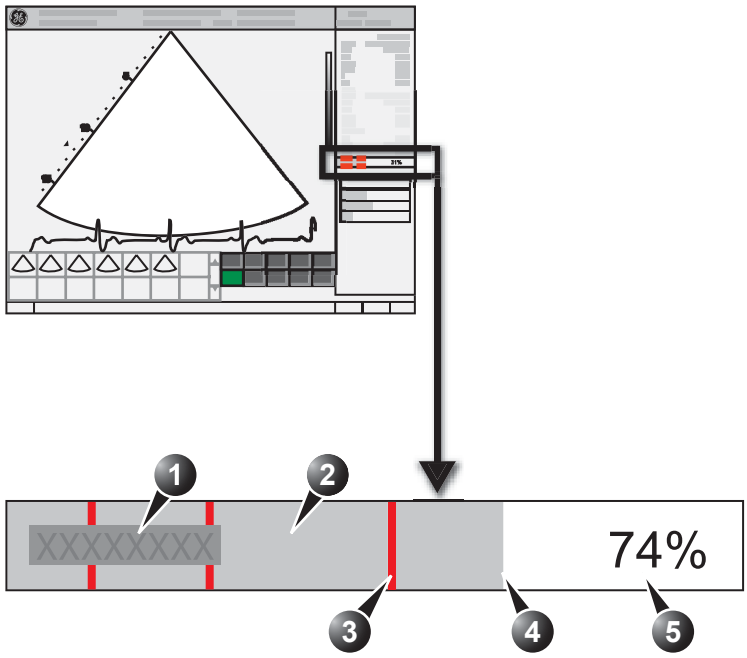


Figure 4-5: The buffer bar in Continuous capture

Controlling the capture process

When entering a stress level with Continuous capture enabled, the unit is automatically set in Pause mode.

1. Press **IMAGE SRORE** or **2D FREEZE** to start image capture. “Capture” is displayed in the buffer bar, the gauge starts filling and the percentage of filled memory buffer increases (see Figure 4-5, page 156).
2. Press **IMAGE SRORE** or **2D FREEZE** again to stop capture. “Pause” is displayed in the buffer bar.

When 90% of the memory buffer is filled up, the text display in the buffer bar turns red.

The unit enters Freeze mode automatically once the buffer is full and the captured loops are displayed in the *Continuous capture selection screen* (see below).

Running Continuous capture

*The application **Exercise** should be used in order to get maximum continuous capture buffer.*

*The Exercise protocol template is automatically selected when the application **Exercise** is active.*

1. Do all your pre-stress acquisitions in the Cardiac application.
2. Press **PROTOCOL** to enter the stress echo mode.
   The *Protocol screen* is displayed (see Figure 4-1, page 149).
3. Press **Template**.
   The template list is displayed.
4. Select the template **Exercise**.
5. Press **Begin/Cont**.
6. Acquire the resting loops in all four views.
7. Once the fourth loop is acquired the system enter into a waiting mode where Continuous Capture is in pause state awaiting the patient to exercise.
8. When the patient is back on the bed, press **IMAGE STORE** or **2D FREEZE**. The Continuous capture acquisition is started.
9. Acquire all your views.
   The memory buffer gauge increases (Figure 4-5). When memory filling exceeds 90%, the percent number turns red.
10. Press **FREEZE** to finish.
11. Press the **SELECT CYCLE** assignable.
    The *Continuous capture selection screen* is displayed (see Figure 4-6, page 160).
    If the buffer is filled up the system will automatically display the *Continuous capture selection screen*.
    Refer to the next section if additional image acquisition is necessary after the buffer is filled up.
12. Assign the cineloops to the four views (see page 160).
    A dialogue window is displayed asking whether the entire Continuous capture acquisition should be saved or not.

Saving the entire loop takes 5 to 10 seconds on LocalArch-IntHD and several minutes on LocalArch-MOD.

13. Press **Delete** to discard the loop
    or
    Press **Store all** to keep the entire loop.
14. Perform Analysis and scoring (see page 163).

Continuous capture with additional image acquisition

If the buffer is filled up before all the image acquisitions are done, additional loops can be stored in the clipboard before doing image assignment to the views:

1. Perform Continuous capture as described above (steps 1 to 10).
2. • If the buffer is not filled up: press **More** and **Protocol Pause**. Live scanning is activated.
   • If the buffer is filled up: press **Select later** in the *Continuous capture selection screen*. Live scanning is activated.
3. Perform the additional acquisition (e.g. CFM, Doppler). Images will be stored outside the protocol.
4. In order to resume the stress echo exam and assign loops for the views from the Continuous capture buffer, press **PROTOCOL**.
5. Press on the **Continuous capture icon** on the lower left corner of the *Protocol screen*.
   The *Continuous capture selection screen* is displayed.
6. Assign the cineloops to the views (see page 160).
   A dialogue window is displayed asking whether the entire Continuous capture acquisition should be saved or not.
7. Press **Delete** to discard the loop
   OR
   Press **Store all** to keep the entire loop.
   The normal procedure is to discard the loop. The loop is very big and will take a lot of disk space.
8. Perform Analysis and scoring (see page 163).

Postponed image assignment

The assignment of the cineloops to the views can be done on a later stage on a stored Continuous capture acquisition.

1. Perform Continuous capture as described in ’Running Continuous capture’ on page 157 (steps 1 to 11).
2. Press **Store all**.
   The entire Continuous capture acquisition is stored. The examination can be ended and the image assignment, analysis and scoring can be done on a later stage.
3. Re-open the examination if necessary.
4. Press **PROTOCOL**.

The continuous capture loop is very big, and ending the exam may take several minutes if storing through a slow network or storing to MOD.

The *Protocol screen* is displayed.

5. Press on the **Continuous capture icon** on the lower left corner of the *Protocol screen*.
   The *Continuous capture selection screen* is displayed.
6. Assign the cineloops to the views (see page 160).
7. Press **Done** when finished.
8. Press **Delete** to discard the loop
   OR
   Press **Store all** to keep the entire loop.
   The normal procedure is to discard the loop. The loop is very big and will take a lot of disk space.
9. Perform Analysis and scoring (see page 163).

Restart capture from the Continuous capture selection screen

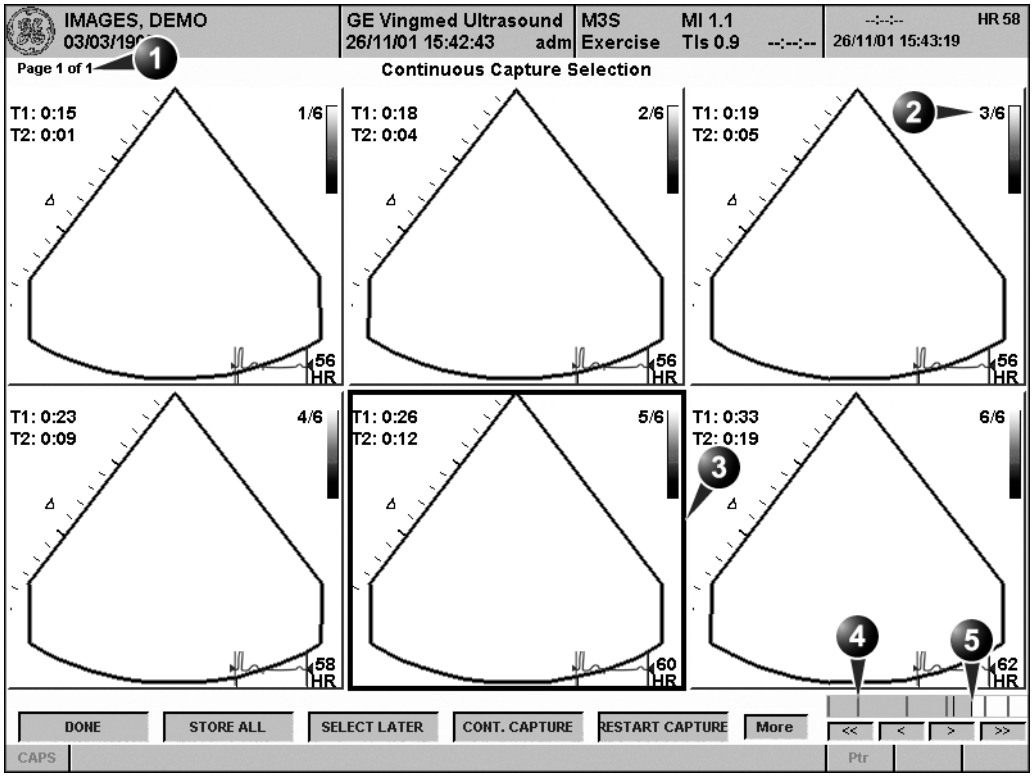
1. Press **RESTART CAPTURE**.
   The recording in memory is deleted and the Continuous capture is started again.

Resume Continuous capture

1. Press **CONTINUE CAPTURE**.
   Resumes Continuous capture recording (only if the Continuous capture buffer is not full).

Assigning and storing the loops

The cineloops captured in the buffer are assigned to the stress protocol views and stored from the *Continuous capture selection screen* (see Figure 4-6).



1. **Rotate CHANGE PAGE assignable to display other pages**
2. **Cycle number and total number of cycles**
3. **Highlighted loop**
4. **Red bar: pause session**
5. **Grey gauge: position of the highlighted loop within the buffer area**

Figure 4-6: The Continuous capture selection screen

Assigning a cineloop to a view

1. Trackball to the desired loop in order to assign it to a particular view of the stress template.
   The frame of the loop is highlighted.
2. Press **SELECT**.

A pop-up menu is displayed with the view names of the template (see Figure 4-7).

The views that are already assigned are tick marked (see Figure 4-7).

3. Trackball to the required view name.
4. Press **SELECT**.
   The name of the view is displayed above the timers in the loop window.
5. Repeat steps Figure 1 through Figure 4 to assign loops to the other views of the level.
6. Press the assignable **DONE** when completed.
   A dialogue window is displayed asking whether the entire Continuous capture acquisition should be saved or not.
7. Press **Delete** to discard the loop
   OR
   Press **Store all** to keep the entire loop.
   The normal procedure is to discard the loop. The loop is very big and will take a lot of disk space.

Saving the entire loop takes 5 to 10 seconds on LocalArch-IntHD and several minutes on LocalArch-MOD.

1. **Assigned loop**
2. **Highlighted loop**
3. **Views pop-up menu**
4. **Highlighted views**
5. **Already assigned view**

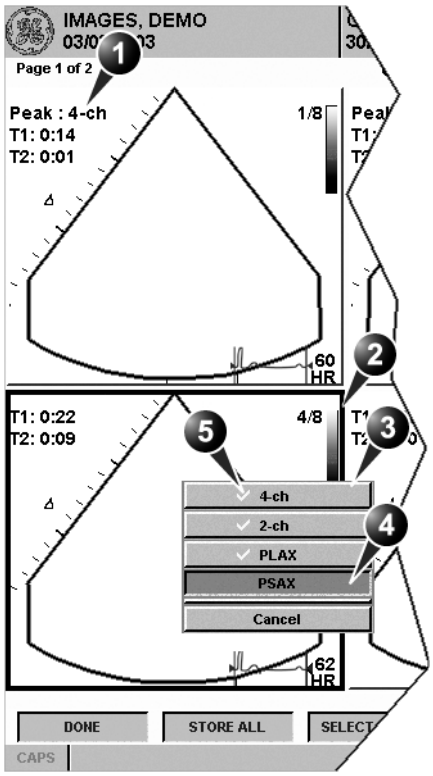


Figure 4-7: Loop assignment in Continuous capture

Analysis

Analysis consists of viewing previously saved loops and assigning scores to each cardiac segment, in order to quantify the function of the muscle, or wall motion.

Depending on the protocol configuration, the analysis stage can be started automatically after completion of the stress test or it can be started manually. In this case, the usual procedure consists of sequentially opening all image groups (if defined) and perform scoring from image to image.

The quad screen is the standard display for comparing heart cycles (Figure 4-9). The heart cycle loops in the display are synchronized to enable comparison. Each loop in the quad screen can be magnified, using the zoom control (see page 70).

Image selection for analysis

Images can be selected manually or from a pre-defined group in the *Protocol screen*.

Selection of images from a group

If groups of images have been defined in the protocol template (see page 183), the user can select a group of images for analysis and sequentially analyze all images from all groups from within the *analysis screen* (see Figure 4-9, page 165).

1. In a stress examination, press **PROTOCOL**.
   A preview of the acquisitions is displayed.
2. Trackball to a group in the *Group list*.
   The frame of the images belonging to the group are highlighted.
3. Press **SELECT** to open images in the *Analyze screen* (see page 165).

1. **Select a Projection**
2. **Select an image**
3. **Select and open an Image group**

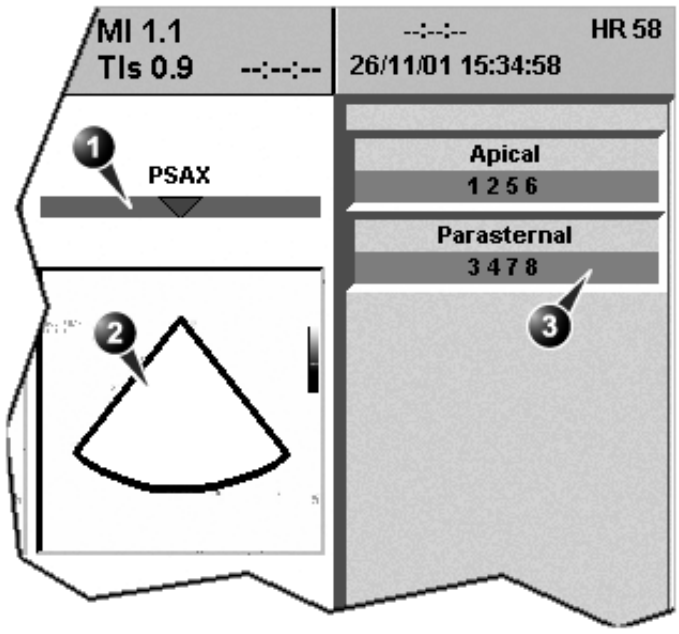


Figure 4-8: Image selection from the Protocol screen

Manual selection of images in the Analysis screen

1. When currently in protocol analysis in the *Stress analysis quad screen* (Figure 4-9), hold down **SHIFT** while performing steps 2 to 4.
2. Trackball to the first image to select in the *Template matrix*.
3. Press **SELECT**.
   The selected loop is displayed in the *Stress analyze screen* and the next window in the quad screen is automatically selected.
4. Repeat steps 2 and 3 to select other images.
5. Depress **SHIFT**.

Manual selection of images in the Protocol screen

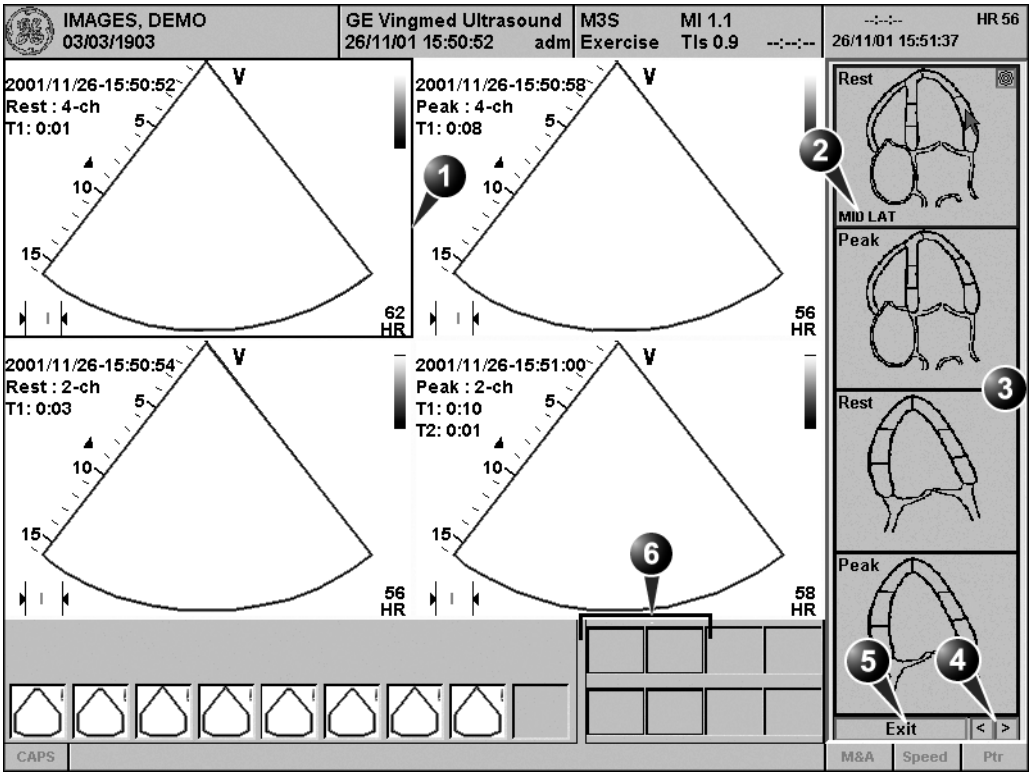
1. In a stress examination, press **PROTOCOL**.
   A preview of the acquisitions is displayed.
2. Trackball to the first image to select.
3. Press **SELECT**.
   The frame of the selected loop is highlighted.

4. Repeat steps 2 and 3 to select other images.
5. Press **ANALYZE** to open images in the *Analyze screen* (see page 165).

Alternative: Double click on the last selected image to open images.

Scoring acquired loops

1. After image selection (see page 163), press **ANALYZE**. The *Stress Echo Analysis screen* is displayed (see Figure 4-9).



1. **Selected loop (highlighted frame)**
2. **Highlighted segment name**
3. **Wall segment diagrams**
4. **Change page or enter next image group**
5. **Exit Wall motion scoring**
6. **displayed loops (highlighted frames)**

Figure 4-9: The stress echo analysis screen (Quad screen)

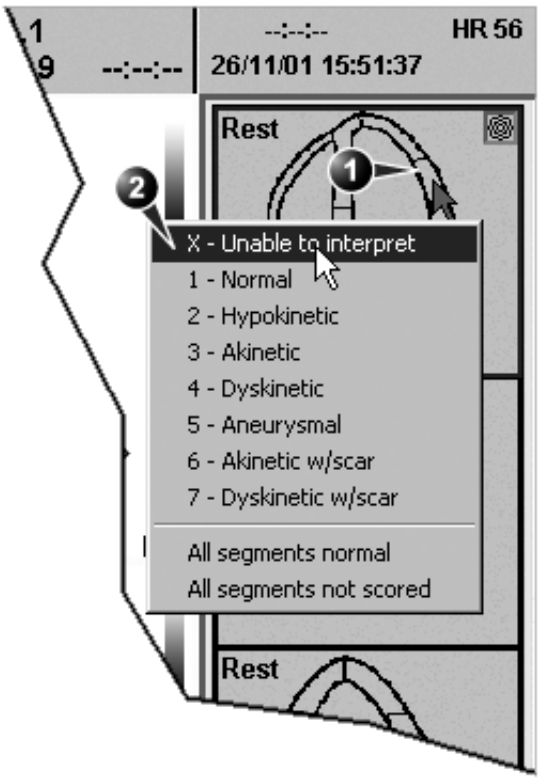
To edit a score, select it and choose a new score.

2. Trackball to a segment in one of the scoring diagrams and press **SELECT**.
   The *Score pop-up list* is displayed (see Figure 4-10).

Alternative: Press the arrow heads at the bottom of the scoring diagram (see Figure 4-9)

3. Trackball to a score.
4. Press **SELECT**.
   The score is displayed in the relevant segment area in the diagram (see Figure 4-10).
5. Repeat steps 1 through 3 to score relevant segments.
6. Rotate the assignable **CHANGE PAGE** to display next group of images.
7. Repeat steps 1 through 3 to score relevant segments on the new loops.

1. **Selected segment**
2. **Selected score**



1. **Scored segment**

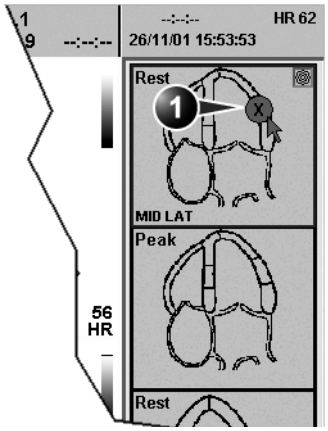


Figure 4-10: Segment scoring

Blood pressure monitoring

The blood pressure (systolic and diastolic) for the selected view is displayed over the scoring diagrams (Figure 4-10).

1. Press **BP**.
   the systolic and diastolic blood pressure data for all levels is displayed in a dialogue window.

The blood pressure data in the dialogue window can be edited.

Quantitative TVI Stress echo analysis

WARNING

QTVI Stress analysis is meant as a guide to wall motion scoring.

Diagnosis must not be based on results achieved by QTVI Stress analysis only.

The Vivid 7/Vivid 7 PRO Ultrasound unit provides a Quantitative TVI (QTVI) Stress analysis package based on Tissue velocity information (TVI). The TVI data is stored in a combined format with grey scale imaging during stress examination.

When selecting a template supporting TVI data acquisition, the ultrasound unit will automatically store TVI information, generally for the apical views of the stress examination.

The QTVI Stress analysis option currently applies only to Dobutamine stress-echo.

Wall Motion Scoring remains the basis for the diagnosis of CAD in stress echocardiography. QTVI Stress may be used as a guidance tool to check this interpretation.

The current version of QTVI Stress is based on the assessment of peak velocity at peak Dobutamine stress (see reference 1 on page 176). The normal ranges have been validated in the “average” patient presenting for stress testing. The velocity cutoff values for the Vpeak measurement will not work in the following cases:

- Submaximal stress (<85% predicted max HR)
- Patients at extremes of age (<40 or >70)
- Previous myocardial infarction / revascularization
- Previous heart-failure / cardiomyopathy / hypertrophy / arrhythmia / aortic regurgitation

Velocity measurements in mid and basal segments of the myocard will contain contributions from the apical region of the myocard. E.g. if measured value in a mid segment is below the cutoff value for this segment then this might relate to a reduced function in the mid or apical region.

The velocity cutoff values are based on placing the sample volume at center of each cardiac segment at start of systole, the left ventricle myocardial segments are defined by the American Society of Echocardiography 16 segments model. However, the velocity cutoff model does not cover the apical segments (due to low velocities and segment orientation), (see side note).

Tissue Doppler does not have perfect site-specificity because of tethering by adjacent segments. Thus, although an ischemic segment has little thickening (and therefore could be expected to show low velocity), measured velocity may be influenced by local tethering, reflecting contraction in surrounding segments. Conversely, a normal segment may have its velocity reduced by an adjacent segment with reduced velocity. This tethering effect may decrease the sensitivity for single vessel disease, but nonetheless the sensitivity and specificity of the cut-offs are approximately 80% (see reference 1 on page 176).

Three different analysis tools based on TVI data are available:

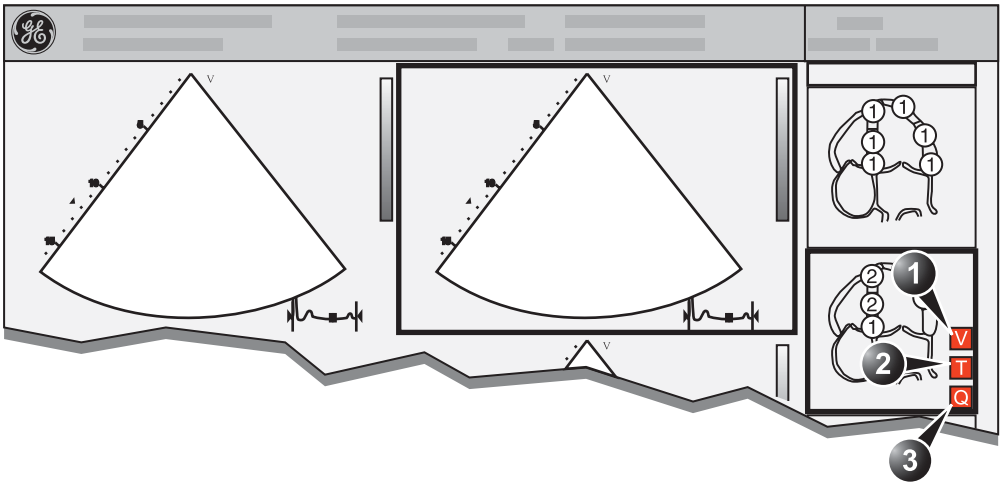
- **’Vpeak measurement’ on page 171**, enables the display of a tissue velocity trace for a selected region of a previously scored segment through the entire heart cycle. In addition Vpeak is color-coded on the 2D image. From the velocity trace, the user can estimate the peak systolic velocity (see reference 1 on page 176).

  This tool is available in views from peak levels only and only when a segment has been scored in one of these views.
- **’Tissue Tracking’ on page 175**, enables visualization of the systolic contraction of the heart by color-coding the myocardial displacement through the systole.
- **’Quantitative analysis’ on page 176**, enables further quantitative analysis based on multiple tissue velocity traces.

  The quantitative analysis is described in Chapter 7, ’Quantitative Analysis’ on page 233.

Accessing QTVI Stress analysis tools

The three QTVI Stress analysis tools are entered by pressing a dedicated button on the scoring diagram (see Figure 4-11) of the selected view. Only views with TVI data acquired will display QTVI Stress tools buttons on the respective diagrams.



1. **Vpeak measurement (V-peak measurement is displayed in views from peak levels and only after scoring.)**
2. **Tissue Tracking**
3. **Quantitative analysis**

Figure 4-11: QTVI Stress tools buttons

Vpeak measurement

This tool enables the user to generate a tissue velocity profile for a given wall segment through the entire heart cycle and display color-coded Vpeak in tissue.

From the velocity trace, the user can determine whether the systolic Vpeak is over or under a clinically determined velocity threshold (see reference 1 on page 176) to confirm the wall motion scoring.

△
CAUTION

QTVI Stress can be used only in conjunction with wall motion scoring analysis, as a guiding tool.

When activating QTVI Stress, the measurement applies only to the currently highlighted segment for the current level and projection view.

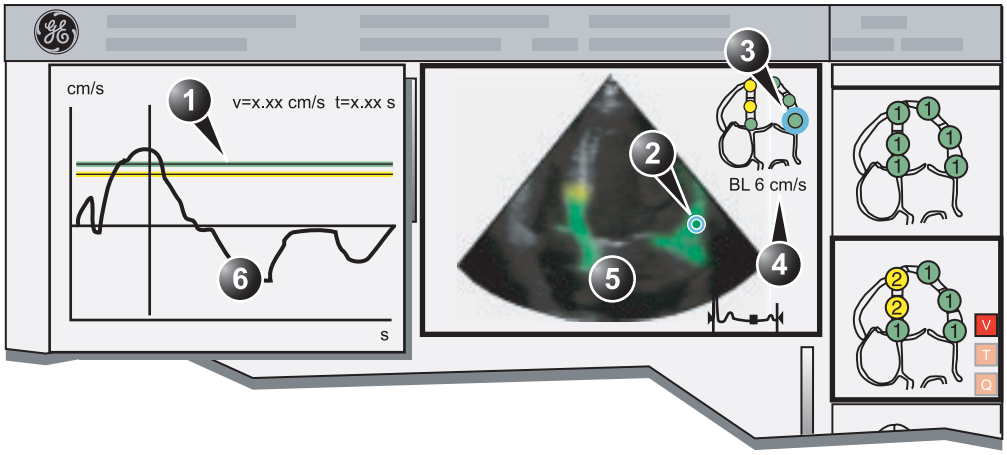
To display a Vpeak measurement

1. Perform segment scoring as described on page 165. When performing scoring i a view from a peak level, the Vpeak measurement button (**V**) is displayed in the corresponding diagram.
2. In the *Scoring diagram*, press **V**.
   The trackball cursor is changed to sampling area and the scored peak views are updated showing:
   - A diagram with the current segment highlighted (scoring bullet with a ring) and the segment's velocity cutoff (see Figure 4-12).
   - Color-coded velocity in tissue. The color-coding convention is as follow:
     - **Green**: Velocities above threshold value + 5%
     - **Yellow**: Velocities near threshold (+/- 5% interval)
     - **White**: Velocities below threshold value - 5%
   - A result window to display tissue velocity profile, shown when moving the sampling area in the view.
3. In the 2D sector, trackball the sampling point over the wall area corresponding to the current segment (shown as the highlighted segment in the diagram).
   A tissue velocity profile for the actual segment is generated in the *Result window* (see Figure 4-12).
4. Use **SEGMENT SELECT** assignable to analyze the other segments in the peak view,
   Or
   Select another scoring bullet in the diagram in one of the peak views.

See page 174 for further information on Vpeak measurement interpretation.

Turn-off the Vpeak measurement tool

1. Trackball to one of the V button in the peak view scoring diagrams.
2. press **SELECT** in the trackball area.



1. **Threshold for current segment (green)**
2. **Sampling point**
3. **Current segment**
4. **Vpeak threshold for current segment**
5. **Color-coded tissue velocity:**
6. **Result window with tissue velocity profile**

Color-coding (velocity thresholds and tissue):

- **Green: velocities above threshold value**
- **Yellow: velocities near threshold (0 to -10% interval)**
- **White: velocities below threshold value - 10%**

Figure 4-12: Vpeak QTVI Stress display

V-peak measurement interpretation

The systolic Vpeak in the tissue velocity profile is automatically detected and highlighted by a vertical bar (see Figure 4-12). The automatically detected Vpeak should be visually verified by the user. In addition Vpeak thresholds are displayed as color-coded horizontal lines (see Figure 4-12). These thresholds represent statistical guideline values for peak velocity at peak stress level (Dobutamine stress procedure) for the three apical views. Only threshold values for basal and mid-segments for each apical view are defined (see reference 1 on page 176). The result is highlighted by a color-coding of the thresholds lines, the color-coding in the 2D image and the scoring bullet (see Figure 4-12).

Tissue Tracking

Tissue Tracking calculates and color-codes the displacement in tissue over a given time interval. The displacement is found as the time integral (sum) of the tissue velocities during the given time interval. The color-coded displacements calculated in the myocardium are displayed as color overlay in the respective acquisition window.

By studying the color patterns generated in the different segments, the user can confirm the standard segmental wall motion scoring at peak levels.

To display Tissue Tracking

1. Trackball to a loop with TVI data (usually an apical view at peak level).
2. Press **SELECT** on the control panel.
3. Trackball to the corresponding *Wall segment diagram*.
4. Press **T** on the *Wall segment diagram field* (see Figure 4-11, page 171).
   The Tissue Tracking color overlay is displayed in the *Acquisition window*.

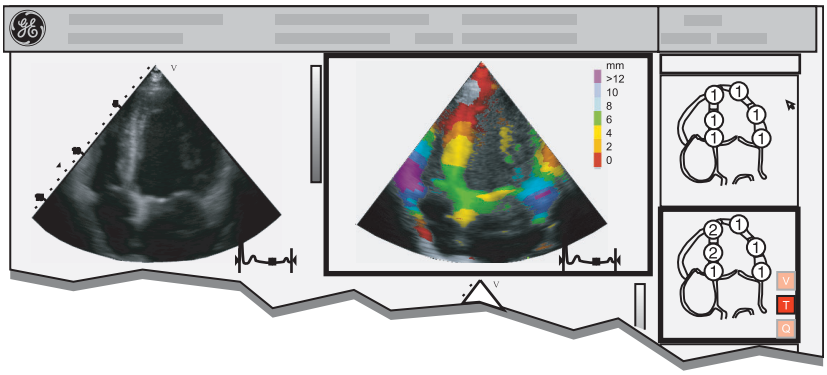


Figure 4-13: Tissue Tracking display

Quantitative analysis

Quantitative analysis enables further analysis based on multiple tissue velocity traces. Quantitative analysis is performed using the Quantitative analysis package described in Chapter 7, 'Quantitative Analysis' on page 233.

To start quantitative analysis

1. Trackball to a loop with TVI data (usually an apical view at peak level).
2. Press **SELECT** on the control panel.
3. Trackball to the corresponding *Wall segment diagram*.
4. Press **Q** on the *Wall segment diagram field* to launch the Quantitative analysis package (see page 233).

References

1. **Application of Tissue Doppler to Interpretation of Dubotamine Echocardiography and Comparison With Quantitative Coronary Angiography.** Cain P, Baglin T, Case C, Spicer D, Short L. and Marwick T H. *Am. J. Cardiol. 2001; 87: 525-531*

Editing/creating a template

The stress package provides protocol templates for exercise as well as pharmacological stress examinations. The user can create new templates or modify existing templates to suit the individual needs. Up to ten projections and fourteen stress levels can be created in a template.

Templates created may be temporary, used only during the current examination, or saved as new templates, for future use and reference. The editions that may be performed include:

- Adding/deleting levels and projections, page 181
- Assigning new labels to levels and projections, page 182
- Defining level options, page 182
- Defining new groups, page 183

Templates are edited/created from the *Template editor screen*.

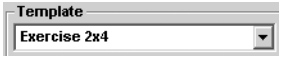
Entering the Template editor screen

1. Press **PROTOCOL** to enter the stress echo mode.
2. Press the assignable **TEMPLATE**.
   The *Template pop-up menu* is displayed.
3. Trackball to **Template Editor**.
4. Press **SELECT**.
   The *Template editor screen* is displayed (see Figure 4-14).

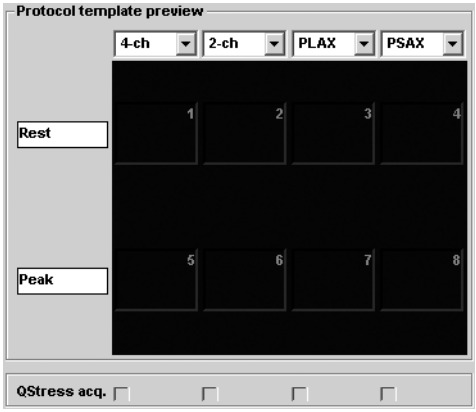
Template editor screen overview

Figure 4-14: The Template editor screen

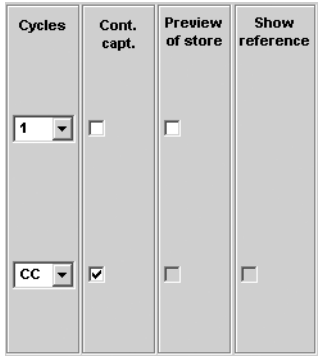
Template

Parameter	Description
	**Template:** • select a pre-defined template from the pop-up menu. The *Protocol template preview* (see below) is updated accordingly.

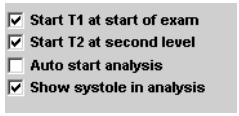
Protocol template preview

Parameter	Description
	**Protocol template preview:** • displays an updated preview of the template accordingly to the settings applied. • To change *Projection* and *Stress level labels*, select a pre-defined label from the pop-up menu or press **SELECT** in the actual label field and type a new name. **Q Stress acquisition**: enables TVI data acquisition for QTVI Stress analysis.

Template settings

Parameter	Description
	**Template settings:** • **Cycles**: select the number of cineloop heart cycles to store for each level from the drop-down menu. • **Continuous capture**: ☑: enables continuous image acquisition throughout the level. The images acquired are temporarily stored in the unit's storage buffer. • **Preview of store**: ☑: enables review and adjustment of cineloops before storage (see page 273 for further information). • **Show reference**: ☑: displays a dual screen with the reference level (first or previous level) on the left and the live image on the right.

Other options

Parameter	Description
	Grid size: • Enter the number of levels and projections for the selected template.
 	**Timers:** • ☑: starts T1 and T2 timers automatically **Auto-start analysis:** • ☑: displays the *Stress Echo Analysis screen* when the last acquisition is performed. **Smart Stress:** • ☑: stores a subset of the image acquisition settings (geometry incl. zoom, gain, compress, reject, power...etc) for each view in the protocol. Smart Stress enables to set image acquisition settings for each view at baseline level and automatically get the same image settings in the corresponding views in the next levels. In Continuous capture acquisition at peak stress, the active cell must be moved manually through the views using the arrow buttons (or foot pedal).
	Reference image: • When **Show Reference** is selected (see page 179), selects either corresponding baseline loop or corresponding loop from the previous level to be displayed as reference image during acquisition.

Pre-defined groups

Parameter	Description
	Pre-defined groups: • Shows the image groups created. • **New group**: creates a new image group. Select the desired images on the template preview (see page 183). • **Update group**: edits a selected group after new loop selection on the template preview (see page 183). • **Delete group**: deletes selected group (see page 183).

Editing/Creating a template

Selecting a base template to edit

Determine the required number of projections and levels you need and select the most appropriate foundation template.

1. Trackball to the *Template pop-up menu* on the upper left corner of the *Template editor screen*.
2. Press **SELECT** on the arrow.
   The *Template pop-up menu* is displayed.
3. Trackball to the base template to edit.
4. Press **SELECT**.
   The selected template is displayed in the *Protocol template preview field*, showing the levels and projections and their labels.

Adding/deleting levels and projections

1. Enter the number of levels and projections in the *Grid size field* (see Figure 4-14).
   The new grid size is displayed in the *Protocol template preview field*.
2. Press **New Template** to create a new template.

Or
Press **Save Template** to update the base template.

The timers can also be started or stopped at any time during stress examination using the assignables T1 and T2 on the control panel.

Display timer(s)

1. Check the box(es) to display timer(s) as specified (see Figure 4-14).

Start analysis automatically

1. Check **Auto start analysis** to display the Stress Echo Analysis s*creen* when the last acquisition is performed.

Assigning new labels to levels and projections

1. In the *Protocol template preview field*, Trackball to the *Label field* that is to be changed.
2. Select the *Label pop-up menu* and press **SELECT** on the desired pre-defined label.
   Or
   • If the Label field is empty:
   Press **SELECT** and enter the label or projection name.
   • If the Label field has a name to be changed:
   Press **SELECT** twice (double-click) to highlight the text to be replaced and enter the new label or projection name.

Configuring levels

The following options can be set up for each level:

Number of cycles to be stored in the cineloop:

1. Enter the desired number in the *Cycles field*.
   Up to four cycles/cineloop can be stored.

Continuous capture

1. Check **Continuous capture** if continuous image acquisition throughout the level is desired.
   When Continuous capture is selected, preview of cineloop and reference display (see below) during acquisition are not possible.

Preview of store

1. Check **Preview of store** if review and adjustment of cineloops before storage is desired.

Show reference

1. Check **Show reference** if the display of the corresponding reference loop is desired during acquisition (dual screen

mode).

Adding a group

1. In the *Protocol template preview field* select the cells to be part of the group.
2. In the *Pre-defined group field*, press **New group**.
   A dialogue box is displayed asking the user to enter a name for the new group.
3. Enter the group name.
4. Press **OK**.
   The new group is displayed in the *Pre-defined group field*.

Updating an existing group

A selected group is highlighted by a yellow frame.

1. In the *Pre-defined group field*, select the group to edit.
   The selected cell are highlighted in the *Protocol template preview field*.
2. Either select (a) new cell(s) to add to the group or deselect (an) existing cell(s) to remove from the group.
3. Press **Update group** in the *Pre-defined group field*.
   The display in the *Protocol template preview field* is updated accordingly.

Deleting a group

A selected group is highlighted by a yellow frame.

1. In the *Pre-defined group field*, select the group to delete.
2. Press **Delete group**.
   The group is removed from the list in the *Pre-defined group field*.

Chapter 5
Contrast Imaging

This chapter includes the following information:

• Introduction 186
• Data acquisition 188
- • Left Ventricular Contrast Imaging 188
- • Myocardial Contrast Imaging 194
- • Real-Time Myocardial Contrast Imaging 202

Introduction

The two basic steps of contrast imaging are data acquisition and quantification. Data acquisition is described in this chapter. Quantification is described in Chapter 7, 'Quantitative Analysis' on page 233.

Data acquisition

Three main acquisition applications are available:

- **Left Ventricular Contrast imaging**: optimized for endocardial border detection and assessment of wall motion and wall thickening.
- **Myocardial Contrast imaging**: optimized for assessment of myocardial perfusion. The MC Contrast application is pre-configured to give access to high power settings of the Coded Harmonic Angio technique, which combines the strength of harmonic imaging and power Doppler. MC Contrast application shall be used in intermittent mode. *The application is intended for clinical research.*
- **Real-time Myocardial Contrast imaging (RTMC)**: is intended for visualization of myocardial perfusion by the use of ultrasound contrast agents. As opposed to MC Contrast, RTMC will perform myocardial contrast imaging in a non-triggered mode. *The application is intended for clinical research.*

WARNING

MC Contrast and Real Time MC applications are for research purposes only. Diagnosis must not be based on results achieved by contrast analysis alone.

Quantification

Refer to Chapter 7, 'Quantitative Analysis' on page 233.

Quantification enables the user to perform the following analysis:

- **Time-Intensity analysis**: allows instant time-intensity calculation from up to eight regions of interest (Angio power or tissue intensity display).
- **Curve fitting analysis**: for research studies of myocardial perfusion rates using contrast agents.
- **Arbitrary Anatomical M-Mode (Curved and Straight)**: M-

Mode applied to intensity data calculates and color-codes tissue and Angio intensity along a path drawn by the operator vs. time.

WARNING

Misdiagnosis based on image artifacts

Misdiagnosis in ultrasound contrast images may be caused by several artifacts, most importantly:

Motion artifacts: gives rise to signals independently of contrast presence. This may be caused by patient movement; including respiration, or by probe movement influenced by the operator.

Regional drop outs: caused by unintentional destruction of the contrast agent, too low concentration of contrast agent, poor acoustic penetration due to rib/lung shadows or system failing to detect the contrast agent due to erroneous settings induced by the operator.

Tissue harmonics: gives contrast-like signals independently of the presence of contrast agent.

The field of myocardial perfusion using contrast agents is still a research field. The myocardial applications Real Time MC and MC Contrast are research tools for the development of this field. Default machine settings are set to minimize the amount these artifacts, but the operator has to take these artifacts into account while analyzing the data and confirm the results using other techniques.

Data acquisition

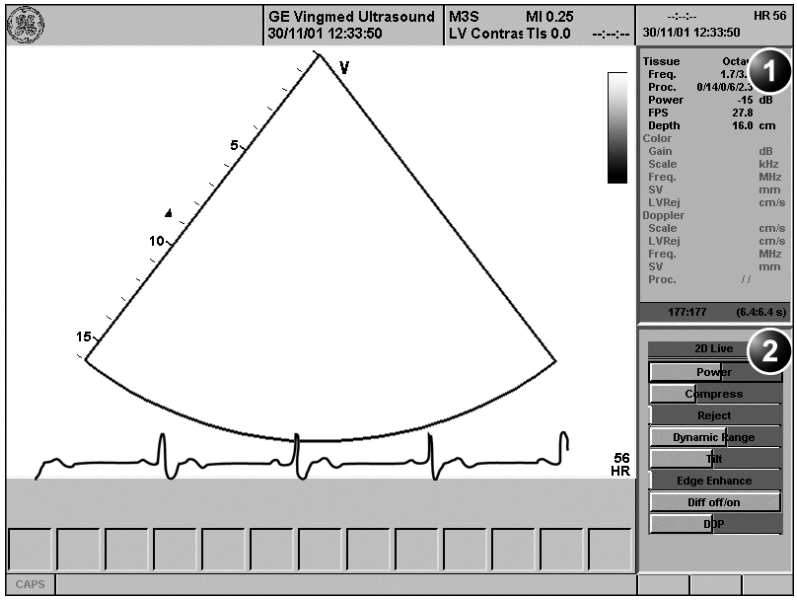
Left Ventricular Contrast Imaging

The Left Ventricular (LV) Contrast application has an optimized system preset for optimal resolution of endocardial borders and for optimal assessment of wall motion and wall thickening.

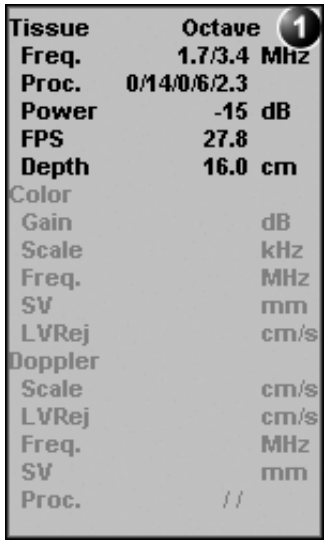
The LV Contrast application may help to identify LV thrombus and evaluate wall motion.

LV Contrast overview

1. **Status window:**
2. **Soft menu**



Controls marked with R are also available in freeze and cine replay.



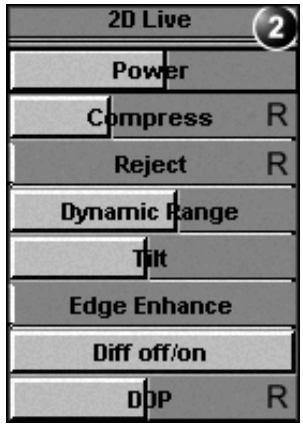
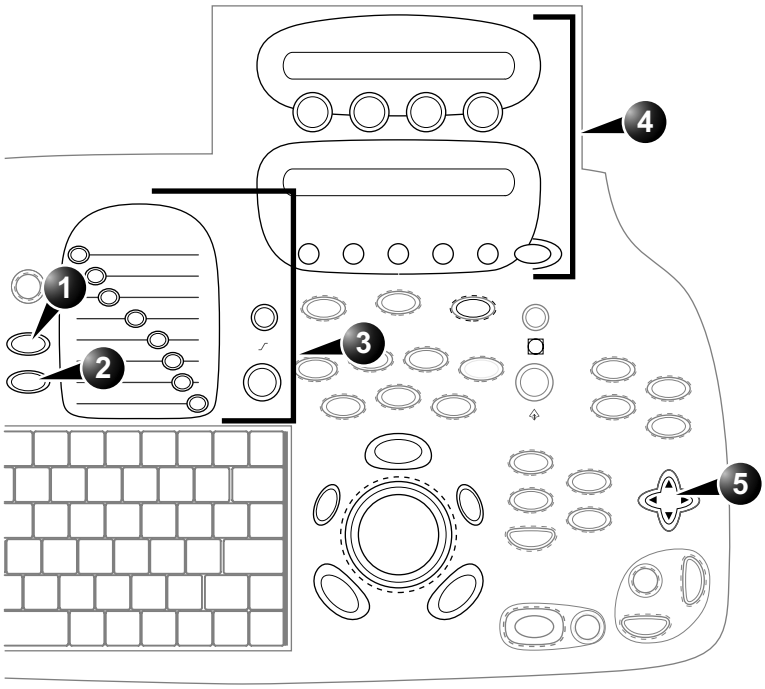


Figure 5-1: The LV Contrast acquisition screen

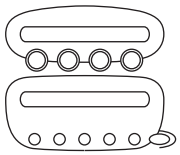


1. **Application**
2. **Probe**
3. **Gain R**
4. **Assignable keys:**
   - **Width**
   - **Frequency**
   - **Focus**
   - **Frame rate**
   - **Up/Down R**
   - **Left/Right R**
   - **Angio**
   - **Cineloop (in Freeze, only)**
   - **Review page (in Freeze, only)**
   - **B color maps**
5. **Soft menu**
   - **Power**
   - **Compress R**
   - **Reject R**
   - **Dynamic Range**
   - **Tilt**
   - **Contour**
   - **Diff On/Off**
   - **DDP R**

Controls marked with ***R*** are also available in freeze and cine replay

Figure 5-2: The LV Contrast controls on the front panel

LV Contrast controls



LV Contrast assignables controls

Width

Controls the size and angular width of the image sector. A smaller angle generally produces a scan with a higher frame rate.

Frequency

Enables the adjustment of the probe's operating frequency. A higher frequency gives better resolution.

Focus

Changes the location of the focal point. A triangular marker on the depth scale along the image sector indicates the position of the focal point.

Frame rate

Lower frame rate gives better resolution.

Controls the line density.

Up/Down

Enables the 2D image to be flipped 180 degrees.

Left/Right

Enables the display of a mirrored image. When applied, the reference marker **V** moves to the other side of the image.

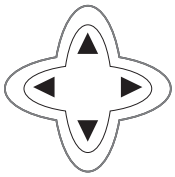
Angio

Turns Coded harmonic angio (color) on/off.

B Color maps

Displays a 2D maps menu to optimized the grey scale presentation. The menu enables an option from a list of non-linear grey-curves or different 2D-colorized curves to be selected.

LV Contrast Soft menu controls



Power

Controls the amount of acoustic power applied to the transmitted pulse.

Too high Power level will destroy the contrast agent.

Compress

Controls the degree of image contrast.

Reject

Controls the Echo rejection level. When increased, low level echoes are rejected and appear darker in the 2D image.

Dynamic Range

Controls the image contrast. A high dynamic range setting gives a softer image.

Tilt

Enables the axis of the 2D image to be tilted to the left or to the right. By default the axis of the 2D image is vertical.

Contour

Controls the image processing related to the extent of edge enhancement applied.

The Diff control decreases the frame rate and the number of focal zones when turned on.

Diff on/off

Affects the level of reverberation in the image. The reverberation in the image is reduced when Diff control is turned on.

DDP (Data Dependant Processing)

Performs temporal processing, which reduces random noise without affecting the motion of significant tissue structures.

Running LV Contrast

The LV Contrast application works only with the M3S, 3S, 5S and 6T probes.

*To select **LV Contrast** application without changing the current probe, press* **APPL.** *on the control panel.*

1. Press **PROBE** on the control panel.
   A list of the connected probes is displayed.
2. Trackball to the desired probe supporting the LV Contrast application.
   The *Application menu* for the selected probe is listed.
3. Trackball to **LV Contrast** application.
4. Press **SELECT** to launch the application.
5. Perform the acquisition.

WARNING

Always read and follow carefully the manufacturer instructions on the contrast agent label.

Optimizing LV Contrast

The default setting for the LV contrast application is optimal setting for the application (MI=0.5; Freq.=1.7/3.4; Focus=9 cm). However, depending on the acoustic window of the patient or the specific contrast agent being used, there may be need for further adjustment.

If image quality is not acceptable before contrast injection, the power level should be increased. When contrast is observed in the left ventricle, the power should be reduced to a level giving homogenous opacification with no destruction (shown as a swirling pattern) of the contrast agent in the LV cavity. If a swirling pattern is observed and persists after the LV cavity has been filled with contrast, the power should be reduced until homogenous opacification is obtained.

CAUTION

Too high Power setting will destroy the contrast agent in the LV cavity.

Myocardial Contrast Imaging

The main goal of the Myocardial (MC) Contrast application is in the assessment of myocardial perfusion.

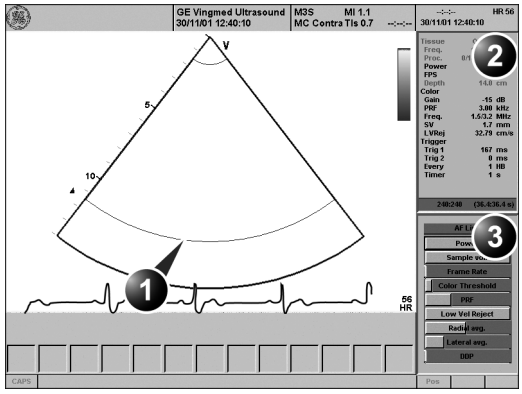
WARNING

This application is intended for clinical research only. Diagnosis must not be based on results achieved by contrast analysis alone.

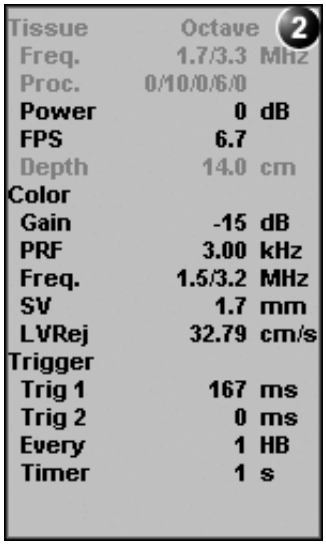
The MC Contrast application is pre-configured to give access to high power settings of the Coded Harmonic Angio technique, which combines the strength of harmonic imaging and power Doppler. MC Contrast application shall be used in intermittent mode.

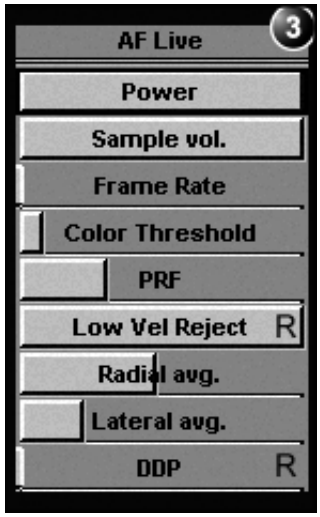
MC imaging overview

1. **Sample volume**



2. **Status window**
3. **Soft menu**





Controls marked with R are also available in freeze and cine replay.

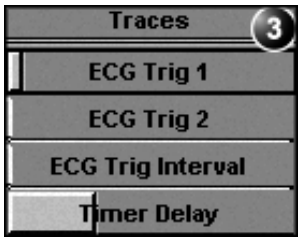
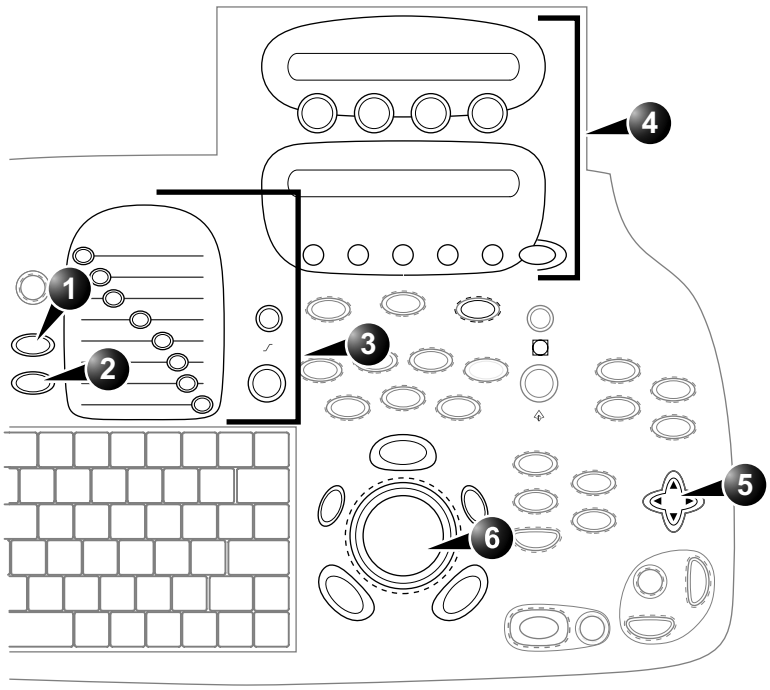


Figure 5-3: The MC Contrast acquisition screen

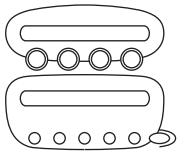


1. **Application**
2. **Probe**
3. **Gain R**
4. **Assignable keys:**
   - **Horizontal sweep**
   - **ECG Trig 1**
   - **ECG Trig 2**
   - **ECG Trig interval**
   - **Simultaneous R**
   - **ECG Trig**
   - **Angio**
   - **Color maps R**
   - **Cineloop (in Freeze)**
   - **Frequency**
   - **Focus**
5. **Soft menu:**
   - **<u>AF Live:</u>**
   - **Power**
   - **Sample volume**
   - **Frame rate**
   - **Color threshold**
   - **PRF**
   - **Low velocity reject**
   - **Radial average**
   - **Lateral average**
   - **DDP R**
   - **<u>Traces:</u>**
   - **ECG Trig 1**
   - **ECG Trig 2**
   - **ECG Trig Interval**
   - **Timer Delay**
6. **Trackball**
   - **ROI position**
   - **ROI size**

Controls marked with ***R*** are also available in freeze and cine replay

Figure 5-4: The MC Contrast controls on the front panel

MC Contrast controls



MC Contrast assignables controls

Horizontal sweep

Adjust the refresh rate of the ECG.

ECG Trig 1

Specifies the delay (ms) from R-wave to the triggered frame.

ECG Trig 2

Specifies the delay (ms) from R-wave to the second frame. *Trig 2* must be greater than *Trig1* for dual triggering to be active.

ECG Trig Interval

Controls the number of cardiac cycles between triggered images.

Simultaneous

Enables simultaneous display of 2D B-mode and 2D Angio Color mode.

ECG Trig

Enables intermittent imaging based on the ECG.

Angio

Turns Coded harmonic angio (color) on/off.

Color Maps

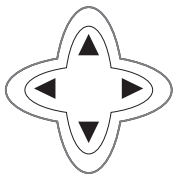
Displays a Color map menu to optimized the color presentation.

Frequency

Enables the adjustment of the probe's operating frequency. A higher frequency gives better resolution.

Focus

Changes the location of the focal point. A triangular marker on the depth scale along the image sector indicates the position of the focal point.



MC Contrast Soft menu controls (2D Angio mode)

Power

Controls the amount of acoustic power applied to the transmitted pulse.

Too high a Power level will destroy the contrast agent.

Color threshold

Controls the level of greyscale intensity that is used as a threshold for color overlay.

PRF (Pulse Repetition Frequency)

Adjusts the repetition rate of the Doppler pulses transmitted to acquire the data for color mapping.

Lower frame rates give better resolution.

Frame rate

Controls the line density.

Low Velocity Reject

Controls the extend of low velocity removal.

Sample volume

Controls the size of the color angio area. Adjustment of the Sample volume may affect the PRF setting.

Radial Averaging

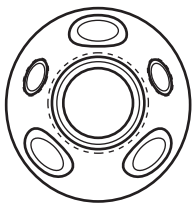
Smooths the image by averaging the data collected along the same radial line.

Lateral Averaging

Smooths the image by averaging data collected along the same lateral line. An increase of the lateral averaging will reduce noise, but will also reduce the lateral resolution.

DDP (Data Dependant Processing)

Performs temporal processing, which reduces random noise without affecting the motion of significant tissue structures.



Trackball controls

ROI (Region Of Interest) size

When the trackball command **Size** is selected (see also 'Trackball operation' on page 59), the height and width of the color area is adjusted by rolling the trackball (up/down, right/left).

ROI (Region Of Interest) position

When the trackball command **Pos** (position) is selected (see also ’Trackball operation’ on page 59), the position of the color area is adjusted by rolling the trackball.

Running MC Contrast

The MC Contrast application works only with the M3S, 3S and 5S probes.

*To select **MC Contrast** application without changing the current probe, press **APPL.** on the control panel.*

1. Press **PROBE** on the control panel.
   A list of the connected probes is displayed.
2. Trackball to the desired probe supporting the MC Contrast application.
   The *Application menu* for the selected probe is listed.
3. Trackball to **LV Contrast** application.
4. Press **SELECT** to launch the application.
5. Press the assignable **ANGIO**.
6. Press the assignable **ECG TRIGGING**.
7. Press **PHYSIO**.
   The *ECG trigging control menu* is displayed (see page 195).
8. Adjust the **Trig 1** using the **Soft menu Rocker**.
   The delay (ms) is displayed in the *Status window* (see Figure 5-3, page 195).

*For dual triggering, **Trig 2** must be greater than **Trig 1**.*

9. Adjust **Trig 2** if dual trigging is used.
10. Press **PHYSIO** again to close the menu.
11. Adjust **Trig interval** from the Assignable keys.
    The number of heart cycles between the frame acquisition is displayed in the *MC Contrast Status window* under Triggering (**Every** (HB)).

A triggering interval from 1:3 to 1:5 is recommended for adequate contrast filling in normal regions.

12. Adjust **Active Gain** from the Control Panel.
13. If desired, press the **SIMULTANEOUS** assignable to prompt a dual screen for side by side display of 2D B-mode and 2D Angio mode.
14. Acquire the baseline images.
15. Press **IMAGE STORE** to save the baseline acquisition.

The contrast solution should be prepared just before injection.

16. Prepare the Contrast agent as described by the manufacturer.
17. Administrate the Contrast agent.
18. Acquire the contrast images.
19. Press **FREEZE**.
20. Press **CINELOOP**.

See also page 62 about cineloop operation.

21. Select **Left marker** and **Right marker** frames to define the cineloop to transfer.
22. Press **IMAGE STORE** to save the contrast acquisition.

Optimizing MC Contrast

- A good baseline image is the key for successful myocardial contrast imaging. Using Coded Harmonic Angio, no colors should be found in the myocardium at baseline.
- The ECG triggering position should be adjusted to avoid wall motion artifacts.
- A triggering interval from 1:3 to 1:5 should be used to allow for adequate contrast filling in normal regions.
- If there is poor contrast in a particular region adjust the focus to this depth.
- If there is too much filling or blooming, decrease the contrast dose or concentration (if attenuation appears) or decrease the sample volume size

Real-Time Myocardial Contrast Imaging

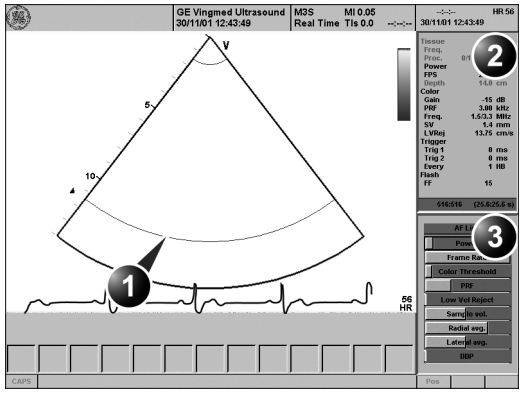
Real-Time Myocardial Contrast (RTMC) is intended for visualization of myocardial perfusion by use of ultrasound contrast agents. As opposed to MC Contrast, RTMC performs myocardial contrast imaging in a non-triggered mode.

⚠ WARNING

This application is intended for clinical research only. Diagnosis must not be based on results achieved by contrast analysis alone.

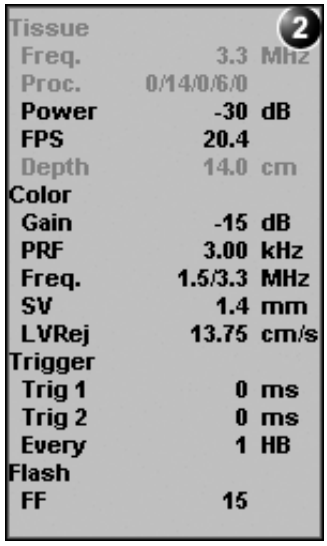
RTMC overview

1. **Sample volume**



2. **Status window:**
3. **Soft menu**

Controls marked with R are also available in freeze and cine replay.



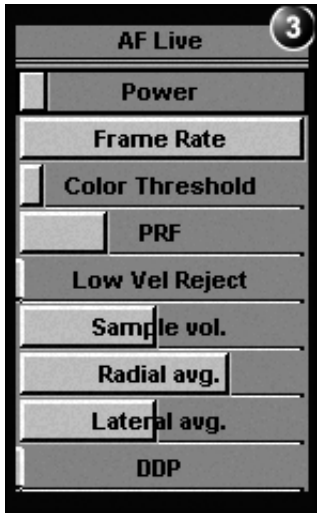
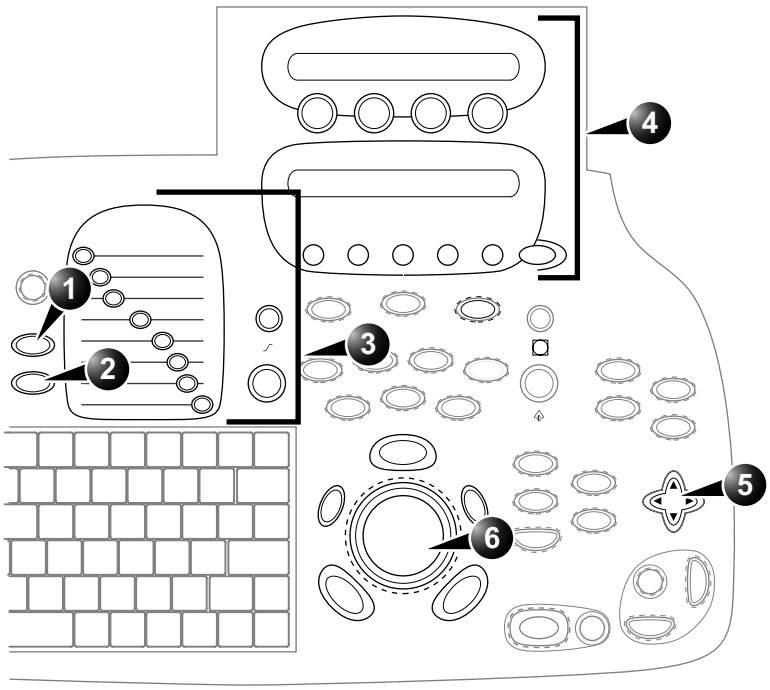


Figure 5-5: The RTMC Contrast acquisition screen

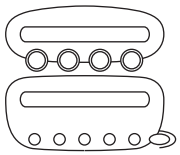


1. **Application**
2. **Probe**
3. **Gain R**
4. **Assignable keys:**
   - **Frequency**
   - **Focus**
   - **Flash**
   - **Flash frames**
   - **Flash gain**
   - **Simultaneous**
   - **Angio**
   - **Color maps R**
   - **Cineloop (in Freeze)**
   - **Flash power**
   - **2D width**
   - **ECG trig**
5. **Soft menu**
   - **Power**
   - **Frame rate**
   - **Color threshold**
   - **PRF**
   - **Low velocity reject**
   - **Sample volume**
   - **Radial average**
   - **Lateral average**
   - **DDP R**
   -
6. **Trackball**

Controls marked with ***R*** are also available in freeze and cine replay

Figure 5-6: The RTMC controls on the front panel

RTMC controls



RTMC Contrast assignables controls

Frequency

Enables the adjustment of the probe's operating frequency. A higher frequency gives better resolution.

Focus

Changes the location of the focal point. A triangular marker on the depth scale along the image sector indicates the position of the focal point.

Flash

Enables the transmission of a pulse with the maximum allowed power over a given time. The purpose of the Flash function is to destroy all contrast agent in the scan plane to create an “artificial” baseline image. The actual MI is displayed in the *Scanner Title bar*.

Flash frames

Controls the length of the Flash specified in number of frames. The duration of the Flash depends on the actual frame rate.

Flash gain

Controls the (receive) gain of the Flash separately.

Simultaneous

Enables simultaneous display of 2D B-mode and 2D Angio Color mode.

Angio

Turns Coded harmonic angio (color) on/off.

Color Maps

Displays a Color map menu to optimize the color presentation.

2D Width

Controls the size and angular width of the image sector. A smaller angle generally produces a scan with a higher frame rate.

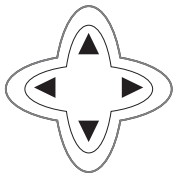
ECG Trig

Enables intermittent imaging based on the ECG.

Flash power

Controls the power (amplitude) of the Flash. The maximum allowed power is default.

RTMC Soft menu controls



Power

Controls the amount of acoustic power applied to the transmitted pulse.

Too high a Power level will destroy the contrast agent.

Color threshold

Controls the level of greyscale intensity that is used as a threshold for color overlay.

PRF (Pulse Repetition Frequency)

Adjusts the repetition rate of the Doppler pulses transmitted to acquire the data for color mapping.

Frame rate

Lower frame rates give better resolution.

Controls the line density.

Low Velocity Reject

Controls the extent of low velocity removal.

Sample volume

Controls the size of the color angio area. Adjustment of the Sample volume may affect the PRF setting.

Radial Averaging

Smooths the image by averaging the data collected along the same radial line.

Lateral Averaging

Smooths the image by averaging data collected along the same lateral line. An increase of the lateral averaging will reduce noise, but will also reduce the lateral resolution.

DDP (Data Dependant Processing)

Performs temporal processing, which reduces random noise without affecting the motion of significant tissue structures.

Running RTMC

The RTMC Contrast application works only with the M3S and 3S probes.

To select RTMC application without changing the current probe, press **APPL.** *on the control panel.*

1. Press **PROBE** on the control panel.
   A list of the connected probes is displayed.
2. Trackball to the desired probe supporting the RTMC application.
   The *Application menu* for the selected probe is listed.
3. Trackball to **Real Time MC** application.
4. Press **SELECT** to launch the application.
5. Press the assignable **ANGIO**.
6. Adjust the **Active Gain** from the Control Panel.
7. Acquire the baseline images.

To go back to single screen, press **SIMULTANEOUS** *again.*

8. Press **STORE** to save the baseline acquisition.
9. If desired, press the **SIMULTANEOUS** assignable to prompt a dual screen for side by side display 2D B-mode and 2D Angio mode.

The contrast solution should be prepared just before injection.

10. Prepare the Contrast agent as described by the manufacturer.
11. Administrate the contrast agent.
12. Press **FLASH** when the contrast agent has reached a stable level (infusion) or just before peak (bolus injection).
    The contrast agent is destroyed in the myocardium.
13. Wait approximately ten heartbeats observing contrast wash-in.
14. Press **FREEZE**.
15. Press **CINELOOP**.

See also page 62 about cineloop operation.

16. Select **Left marker** and **Right marker** frames to define the cineloop to transfer.

Storage of real time data takes considerable space digitally. Be aware of this when selecting more than one cineloop for storage.

17. Press **STORE** to save the contrast acquisition.

Optimizing RTMC

RTMC is by default scanning in low power mode to avoid destruction of slow moving contrast in the myocardium. This setting is required for real time contrast imaging, but is sub-optimal for tissue imaging.

- To obtain good baseline images, the power may be increased prior to contrast injection, but must be reset to its default value before contrast injection or infusion to avoid destruction of the contrast agent.
- If the patient is difficult to image, the power may be slightly increased to get sufficient signal from the contrast agent.

Chapter 6
Cardiac Measurement and Analysis

This chapter includes the following information:

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- **The Assign and Measure modality 211**
  - Starting the Assign and Measure modality 211
  - Entering a study and performing measurements 213
- **Measure and Assign modality 215**
  - Starting the Measure and Assign modality 215
  - Performing measurements 216
  - Post-measurement assignment labels 227
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  - Moving the Measurement result table 229
- **Worksheet 230**
  - Overview 230
  - Using Worksheet 230

Introduction

The Vivid 7/Vivid 7 PRO Ultrasound unit provides functionality for two measurement conventions:

A study is a set of related measurements, or measurements that are logically grouped together. The measurements in a study are sometimes used in a formula to calculate new parameters (e.g. biplane volume with EF, SV and CO).

- **Assign and Measure (Measure Protocols)**: the user selects a study consisting in a set of pre-labeled measurements related to the active scanning mode and clinical application. The user is prompted through the measurements in the order of the measurements labels. This convention is started from the **MEASURE** button on the control panel. A set of tools is implemented to make the measurement process as fast and easy as possible for the user:
  - The user is guided through the study: an auto-sequence functionality automatically selects the next measurement in a study.
  - The selected measurement is highlighted in the *Measurement menu*.
  - The performed measurement is indicated in the *Measurement menu*.
  - The **MENU** key on the control panel enables quick access to the *Measurement menu*.

The studies and their parameters are user-configurable. The user can create its own studies containing the relevant measurements only (see page 406).

- **Measure and Assign (Free style)**: the user performs a measurement and assigns a label. This convention is started either from **MEASURE** or **CALIPER** button on the Control panel.

△
CAUTION

Only assigned measurements will be saved. Measurements without assignment will be lost when scanning is resumed.

The Assign and Measure modality

In this measurement modality, the user selects a study consisting in a set of related pre-labelled measurements.

Starting the Assign and Measure modality

1. Press **MEASURE** on the control panel.
   The *Measurement Menu* is displayed in the *Parameters window* (see example Figure 6-3).
   The trackball cursor is in the scanning window, ready for starting measurement.
2. For fast access to the *Measurement menu*, press **MENU**.
   The cursor is moved to the *Measurement menu*. After selection of a measurement the cursor is automatically moved back to the scanning window, ready for measurement.

In Freeze mode, the **UPDATE MENU** *key on the trackball area has the same function as the* **MENU** *key.*

1. **Menu: fast access to the Measurement menu (when in measure mode)**
2. **Measure: assign and measure**
3. **Caliper: measure and assign (see page 215)**

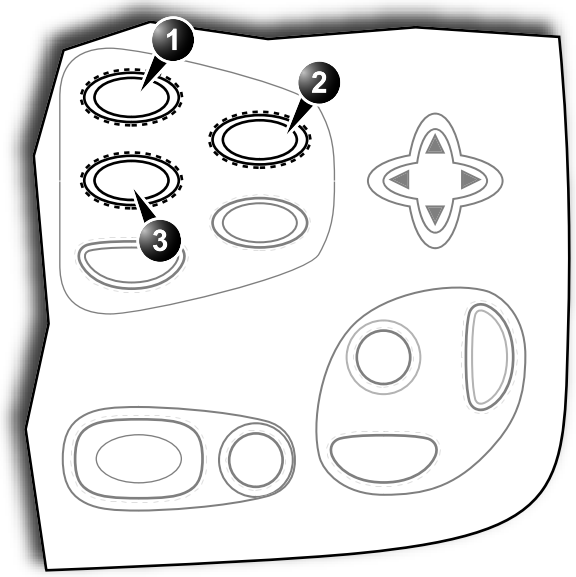


Figure 6-1: Launching the Measurement conventions

1. **Active application**
2. **Study**
3. **Selected study**
4. **Opened study**
5. **Measurements related to the area study for the cardiac application**

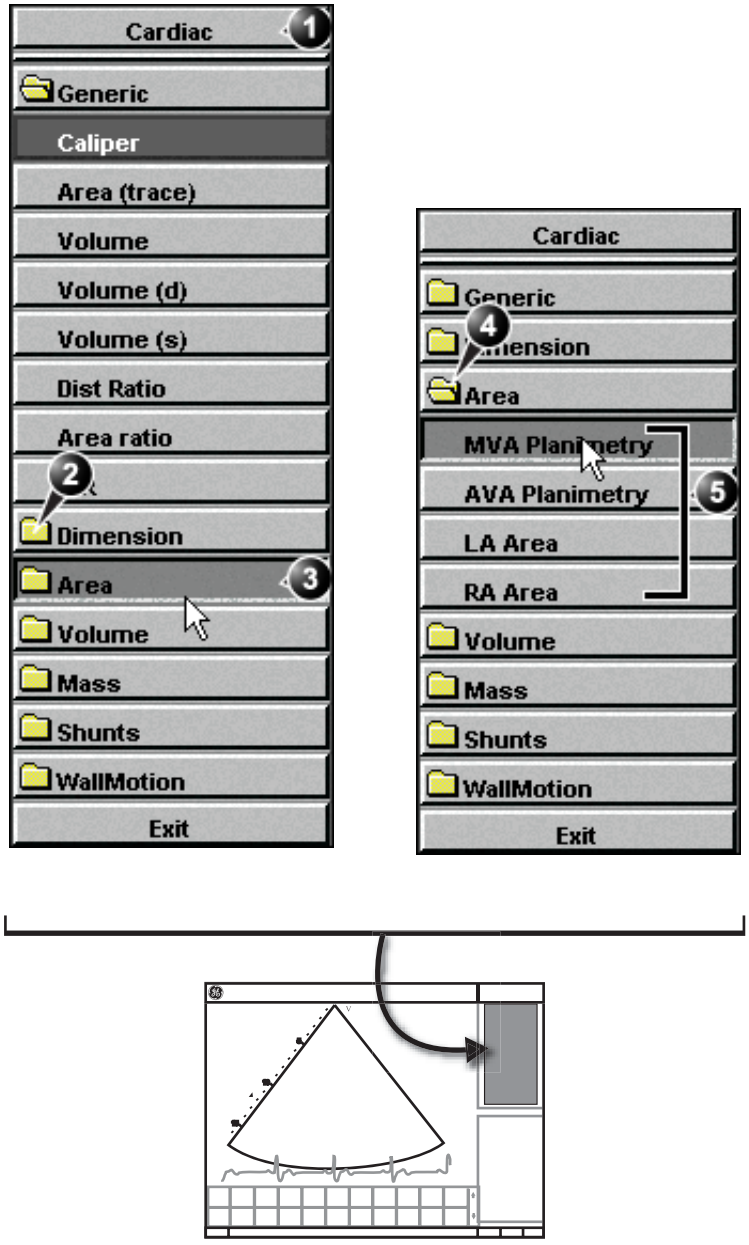


Figure 6-2: Example of a measurement study

Entering a study and performing measurements

1. Press **MEASURE** on the front panel to enter the **Assign and Measure** modality.
   The *Measurement menu* with a list of studies is displayed in the *Parameters window* (see example Figure 6-3).
   When entering the Measurement mode for the first time, the Caliper tool is selected by default. When re-entering the Measurement mode, the first measurement in the actual study that has not been performed is selected by default.

To perform a measurement from another study:

Alternative: Press **MENU** *to access to the* ***Measurement menu*** *and* ***trackball*** *to the actual study*

1. Trackball to the required study.
2. Press **SELECT** on the trackball area.
   The study folder is opened displaying the measurements related to this study. Other related studies may also be available from within the study.
3. Trackball to the measurement to perform.
4. Press **SELECT** on the trackball area to activate the measurement tool.
   The cursor is moved back to the scanning window.
5. Perform the measurement.
   Completed measurements are marked with a check mark Figure 6-3).
   When the measurement operation is completed the next measurement on the list is automatically selected.

To skip a measurement in a study

Alternative: Press **MENU** *to access to the* ***Measurement menu*** *and* ***trackball*** *to the actual study*

1. Trackball to the desired measurement
2. Press **SELECT** to activate the measurement tool.

1. **Performed measurement**
2. **Next measurement is automatically selected**

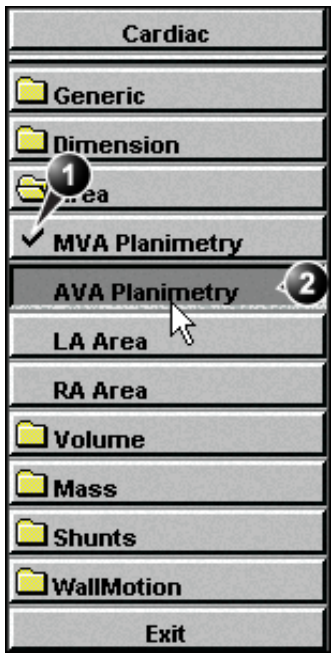


Figure 6-3: Display of a performed measurement (example)

Measure and Assign modality

In this measurement modality, the user performs a measurement and assign a label.

△
CAUTION

Only assigned measurements will be saved.

Starting the Measure and Assign modality

Alternative: Press **CALIPER** *on the control panel and select the measurement tool from the assignables.*

1. Press **MEASURE** on the control panel.
   The *Measurement Menu* is displayed in the *Parameters window* (see example Figure 6-4).
2. If not selected, trackball to the actual measurement tool.
3. Press **SELECT** on the trackball area to activate the measurement tool.
   The cursor is moved back to the scanning window, ready for measurement.

1. Measurement tools

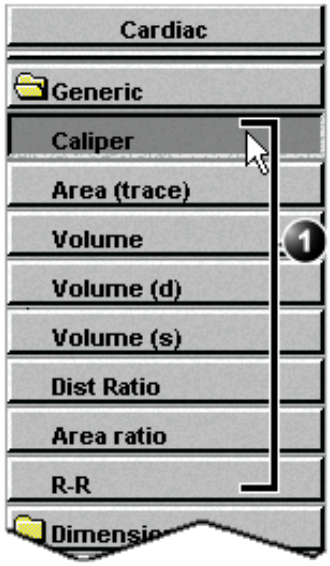


Figure 6-4: The 2D Mode Measurement tools (Cardiac application)

Performing measurements

2D Measurements

2D Length measurements

1. Generate the 2D image.
2. Press **FREEZE** to stop the cineloop.
3. Press **MEASURE** on the Control Panel.
4. Select **Caliper** in the *Measurement Menu* (see Figure 6-2).
5. Trackball the cursor to the start point of the measurement.
6. Press **SELECT** to anchor the start point of the measurement.
7. Trackball the cursor to the measurement end point.
   The current distance value is displayed in the *Measurement result table* and is instantaneously updated when moving the cursor.
8. Press **SELECT** to anchor the end point of the measurement.
   The measurement result is displayed in the *Measurement result table*.
9. To assign a label to the measurement, see page 227.
10. Repeat steps 5 through 8 to make additional length measurements.

Alternative: Press **CALIPER** *on the control panel and press* **CALIPER** *assignable.*

See the ***Status bar*** *to get the next step to perform.*

The measurement display color on the 2D image changes from green to red after completion of the measurement.

2D length measurement ratio

1. Generate the 2D image.
2. Press **FREEZE** to stop the cineloop.
3. Press **MEASURE** on the Control Panel.
4. Select **Dist. ratio** in the *Measurement Menu* (see Figure 6-2).
5. Perform two length measurements as described in steps 5 through 8 in the above section.
   The measurement results including the ratio (%) of the two measured lengths are displayed in the *Measurement result table*.

The measurements displayed on the 2D image and the corresponding results are numbered.

Alternative: Press **CALIPER** *and* **DIST RATIO** *assignable.*

Editing 2D Length measurements

1. Trackball the cursor to one of the anchor points of the measurement to modify.
2. Double-click the **SELECT** key to select the anchor point.
   The selected marker turns green and is unanchored.
3. With the **Trackball**, reposition the marker.
4. Press **SELECT** to anchor.

2D Area measurements

1. Generate the 2D image.
2. Press **FREEZE** to stop the cineloop.
3. Press **MEASURE** on the Control Panel.

Alternative: Press **CALIPER** *and* **AREA** *assignable.*

4. Select **Area (trace)** in the *Measurement Menu* (see Figure 6-2).
5. Trackball the cursor to the start point of the measurement.
6. Press **SELECT** to anchor the start point of the measurement.

See the ***Status bar*** *to get the next step to perform.*

7. Trace the area (planetary) with the **Trackball**.

   The current area and circumference values are displayed in the *Measurement result table* and are instantaneously updated when moving the cursor.

The measurement display color on the 2D image changes from green to red after completion of the measurement.

8. Press **SELECT** to complete the measurement.
   The measurement result is displayed in the *Measurement result table*.
9. To assign a label to the measurement, see page 227.
10. Repeat steps 5 through 8 to make additional area measurements.

The measurements displayed on the 2D image and the corresponding results are numbered.

2D area measurement ratio

1. Generate the 2D image.
2. Press **FREEZE**to stop the cineloop.
3. Press **MEASURE** on the Control Panel.

Alternative: Press **CALIPER**, **MORE** *assignable and* **AREA RATIO**.

4. Select **Area ratio** in the *Measurement Menu* (see Figure 6-2).
5. Perform two area measurements as described in steps 5 through 8 in the above section.

   The measurement results including the ratio (%) of the two measured areas are displayed in the *Measurement result table*.

See the ***Status bar*** *to get the next step to perform.*

Editing 2D Area measurements

1. Trackball the cursor to the anchor point of the area measurement to modify.
2. Press **SELECT** twice (Double-click) to select the anchor point.
   The selected marker turns green and is unanchored.
3. With the **Trackball**, reposition the marker.
4. Press the **SELECT** to anchor.

2D Volume measurements

The measurements described in this section enable volume measurement in a defined zone. The measurements tool generates results by two methods:

*For measurement formulae, refer to the **Reference Manual**.*

- Method of Disk (displayed as **Vmod** in the *Measurement result table*), known as Simpson's method.
- Area/Length method (displayed as **Va-l** in the *Measurement result table*).

To perform a volume measurement:

1. Generate the 2D image.
2. Press **FREEZE** to stop the cineloop.

*Alternative: Press **CALIPER** and **VOLUME** assignable.*

3. Press **MEASURE** on the Control Panel.
4. Select **Volume** in the *Measurement Menu* (see Figure 6-2).
5. Trackball the cursor to the start point where a volume is to be measured.

*See the **Status bar** to get the next step to perform.*

6. Press **SELECT** to anchor the start point of the measurement.
7. Trackball the cursor to draw the length.
8. Press **SELECT** to anchor the second point.
9. Drag the cursor with the **Trackball** to outline the area of interest.

   The current area, circumference and Area/Length Volume (Va-l) values are displayed in the *Measurement result table* (see Figure 6-2) and are instantaneously updated when moving the cursor.

The measurement display color on the 2D image changes from green to red after completion of the measurement.

10. Press **SELECT** to complete the measurement.
    The measurement results including Vmod (Simpson) are displayed in the *Measurement result table* (see Figure 6-2).

The measurements displayed on the 2D image and the corresponding results are numbered.

11. To assign a label to the measurement, see page 227.
12. Repeat steps 5 through 10 to make additional volume measurements.

2D Depth measurements

The measurements described in this section enable depth measurement from the probe to a selected point.

To perform a depth measurement:

1. Generate the 2D image.
2. Press **FREEZE** to stop the cineloop.

*See the **Status bar** to get the next step to perform.*

3. Press **MEASURE** on the Control Panel.
4. Press the assignable **POINT** to select the depth measurement function.
5. Trackball the cursor to the position to measure.
   The current distance from the probe is displayed in the *Measurement result table* and is instantaneously updated when moving the cursor.

The measurements displayed on the 2D image and the corresponding results are numbered.

6. Press **SELECT** to anchor the point.
   The depth value (cm) is displayed in the *Measurement result table*.

M-Mode Measurements

In M-Mode, the user can perform distance and time measurements. This measurement package has also the following pre-defined measurement studies:

- LA/Ao
- LV
- RV

M-Mode Length measurements

1. Generate the M-Mode image.
2. Press **FREEZE** to stop the cineloop.
3. Press **MEASURE** on the Control Panel.
4. Select **caliper** in the *Measurement Menu*.
5. Trackball the cursor to the start point of the measurement.
6. Press **SELECT** to anchor the start point of the measurement.
7. Trackball the cursor to the measurement end point.
   The current distance value is displayed in the *Measurement result table* and is instantaneously updated when moving the cursor.
8. Press **SELECT** to anchor the end point of the measurement.
   The measurement result is displayed in the *Measurement result table*.
9. To assign a label to the measurement, see page 227.
10. Repeat steps 5 through 8 to make additional length measurements.

Alternative: Press **CALIPER** *on the control panel and press* **CALIPER** *assignable.*

See the ***Status bar*** *to get the next step to perform.*

The measurement display color on the M-Mode changes from green to red after completion of the measurement.

The measurements displayed on the M-Mode image and the corresponding results are numbered.

Editing M-Mode Length measurements

1. Trackball the cursor to one of the anchor points of the measurement to modify.
2. Press **SELECT** twice (double-click).
   The selected marker turns green and is unanchored.
3. With the **Trackball**, reposition the marker to a new position.
4. Press **SELECT**.

Ao/LA study

1. Generate the M-Mode image.
2. Press **FREEZE** to stop the cineloop.

Alternative: Press **CALIPER** *on the control panel and press the* **AO/LA** *assignable.*

See the ***Status bar*** *to get the next step to perform.*

The current value is updated while moving the cursor.

3. Press **MEASURE** on the Control Panel.
4. Select **Ao/LA** in the *Measurement Menu*.
5. Trackball the cursor along the time axis to the required point to start measurement of Aorta root diameter.
6. Press **SELECT**.
   The starting point for the measurement is anchored.
7. Trackball to the end point of the measurement.
8. Press **SELECT**.
   The measurement end point is anchored and the value is displayed in the *Measurement result table*.
   A new free-moving cursor is displayed on the image, ready for the next measurement.
9. Repeat steps 5, through 8 to measure Left Atrium.
   The LA value is displayed in the *Measurement result table*.
   The Ao/LA ratio is displayed in the *Measurement result table*.

LV study

The LV study consists of measurements in fixed-time mode in both systole and diastole of:

- Interventricular septum thickness (IVS)
- Left ventricular internal dimension (LVID)
- Left ventricular posterior wall thickness (LVPW)

The following parameters are also calculated:

- EDV (End diastole volume)
- ESV (End systole volume)
- SV (Stroke volume)
- EF (Ejection Fraction)

To perform LV study

1. Generate the M-Mode image.
2. Press **FREEZE** to stop the cineloop.

Alternative: Press **CALIPER** *on the control panel and press the* **LV STUDY** *assignable.*

3. Press **MEASURE** on the Control Panel.
4. Select **LV study** in the *Measurement Menu*.
5. Trackball the cursor along the time axis to the required point to start measurement of IVSd.
6. Press **SELECT**.
   The starting point for the measurement is anchored.
7. Trackball to the end point of the measurement.

8. Press **SELECT**.
   The IVSd measurement end point is anchored and the value is displayed in the *Measurement result table*.

The end point of the IVSd is also the start point for the LVIDd.

1. Trackball to the end point of the LVIDd measurement.
2. Press **SELECT**.
   The LVIDd measurement end point is anchored and the value is displayed in the *Measurement result table*.

The end point of the LVIDd is also the start point for the LVPWd.

1. Trackball to the end point of the LVPWd measurement.
2. Press **SELECT**.
   The LVPWd measurement end point is anchored and the value is displayed in the *Measurement result table*.
3. Repeat steps 5, through 2 to measure IVS, LVID and LVPW in systole.

RV study

The RV study consists of measurement in fixed-time mode of Right ventricular internal dimension (RVID) in both diastole and systole.

To perform RV study

1. Generate the M-Mode image.
2. Press **FREEZE** to stop the cineloop.
3. Press **MEASURE** on the Control Panel.

*Alternative: Press **CALIPER** on the control panel and press the **RV STUDY** assignable.*

4. Select **RV study** in the *Measurement Menu*.
5. Trackball the cursor along the time axis to the required point to start measurement of RVIDd.
6. Press **SELECT**.
   The starting point for the measurement is anchored.

The current value is updated while moving the cursor.

7. Trackball to the end point of the measurement.
8. Press **SELECT**.
   The measurement end point is anchored and the RVIDs measurement value is displayed in the *Measurement result table*.
   A new free-moving cursor is displayed on the image, ready for the next measurement.
9. Repeat steps 5, through 8 to measure RVIDs.

The RVIDs value is displayed in the *Measurement result table*.

Doppler Measurements

The following measurements may be calculated on Doppler mode spectra:

*For measurement formulae, refer to the **Reference Manual**.*

- Maximum (peak) and mean velocity
- Maximum and mean pressure gradient
- Pressure half-time (PHT)
- Velocity time integral (VTI)
- Mitral valve area (MVA), derived from PHT

Velocity and Pressure point measurements

1. Generate the spectrum to be measured.
2. Press **FREEZE** to stop the cineloop.
3. Press **MEASURE** on the Control Panel.

*Alternative: Press **CALIPER** on the control panel and press the **POINT CALIPER** assignable.*

4. Select **Point Caliper** in the *Measurement Menu*.
5. Trackball the cursor to the position to measure.
   The current velocity is displayed in the *Measurement result table* and is instantaneously updated when moving the cursor.

The measurement display on the spectrum and the corresponding results are numbered.

6. Press **SELECT** to anchor the point.
   The velocity (m/s) and pressure (mmHg) values are displayed in the *Measurement result table*.

Velocity and Pressure caliper measurements

1. Generate the spectrum to be measured.
2. Press **FREEZE** to stop the cineloop.

*Alternative: Press **CALIPER** on the control panel and press the **CALIPER** assignable.*

3. Press **MEASURE** on the Control Panel.
4. Select **Caliper** in the *Measurement Menu*.
5. Trackball the cursor to the start point of the measurement.
6. Press **SELECT** to anchor the start point of the measurement.
7. Trackball the cursor to the measurement end point.
   The current velocity and pressure values are displayed in the *Measurement result table* and are instantaneously updated when moving the cursor.

The measurement display color on the spectrum changes from green to red after completion of the measurement.

8. Press **SELECT** to anchor the end point of the measurement.
   The following measurement results are displayed in the *Measurement result table*:
   - Velocity and pressure at anchor point positions
   - Velocity (V3) and pressure (p3) differences between anchor point position

- Time difference (dT) between anchored points position

The measurement display on the spectrum and the corresponding result are numbered.

9. To assign a label to the measurement, see page 227.
10. Repeat steps 5 through 8 to make additional measurements.

Manual Doppler trace measurements

Adjust Compress and reject controls to optimize the Doppler signal.

Alternative: Press **CALIPER** *on the control panel and press the* **MANUAL TRACE** *assignable*

1. Generate the spectrum to be measured.
2. Press **FREEZE** to stop the cineloop.
3. Press **MEASURE** on the Control Panel.
4. Select **Manual trace** in the *Measurement Menu*.
   A vertical green cursor is displayed on the spectrum.
5. Trackball the cursor to the start point on the left side of the trace.
6. Press **SELECT** to anchor the start point of the measurement.
7. With the **trackball**, trace the Doppler envelope.
   The trace can be adjusted, while tracing, by moving the cursor backward to erase portion of the trace (or the entire trace) and then create the trace again.

The measurement display color on spectrum changes from green to red after completion of the measurement.

8. Press **SELECT** to complete the trace.
   The following measurement results are displayed in the *Measurement result table*:
   - Maximum and mean Velocities
   - Maximum and mean pressures
   - Env. Ti
   - Velocity time integral (VTI)
9. Trackball the cursor to the start point of the next heart beat.
10. Press the **SELECT** to anchor the next heart beat starting point.
    The heart rate (BPM) is displayed in the *Measurement result table*.

Automatic Doppler trace measurements

Adjust Compress and reject controls to optimize the Doppler signal.

Alternative: Press **CALIPER** *on the control panel and press the* **AUTO TRACE** *assignable.*

1. Generate the spectrum to be measured.
2. Press **FREEZE** to stop the cineloop.
3. Press **MEASURE** on the Control Panel.
4. Select **Auto Trace** in the *Measurement Menu*.
   A vertical green cursor is displayed on the spectrum.
5. Trackball the cursor to the starting point.
6. Press **SELECT** to anchor the start point of the measurement.

7. Trackball to the end trace position.
8. Press **SELECT** to anchor the end point of the trace.
   The trace is automatically generated and the following measurements are displayed in the *Measurement result table*:
   - Maximum and mean Velocities
   - Maximum and mean pressures
   - Env. Ti
   - Velocity time integral (VTI)
9. Trackball the cursor to the next heart beat.
10. Press **SELECT** to anchor the next heart beat starting point.
    The heart rate (BPM) is displayed in the *Measurement result table*.

MV E/A ratio

Adjust Compress and reject controls to optimize the Doppler signal.

Alternative: Press **CALIPER** *on the control panel and press the* **MV E/A RATIO** *assignable.*

1. Generate the spectrum to be measured.
2. Press **FREEZE** to stop the cineloop.
3. Press **MEASURE** on the Control Panel.
4. Select **MV E/A ratio** in the *Measurement Menu*.
5. Trackball the cursor to the peak of the E wave.
6. Press **SELECT** to anchor the point.
7. **Drag** cursor to baseline to mark dT.
8. Press **SELECT** on the trackball area to anchor the second point.
9. Trackball the cursor to the peak of A wave.
10. Press **SELECT** to anchor the point.
    the velocity at peak for E and A waves and the calculated E/A ratio are displayed in the *Measurement result table*.

Post-measurement assignment labels

Each type of measurement, within each mode, can be associated with a set of pre-defined parameter labels. Parameter labels can be assigned to the highlighted measurement by the user.

To assign a parameter label to a measurement:

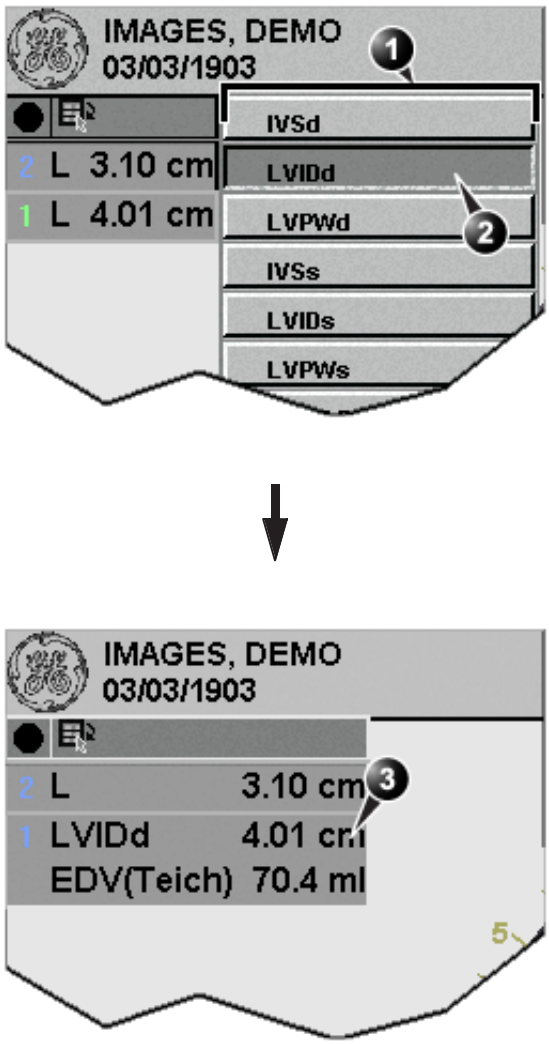
1. Trackball to the actual measurement in the *Measurement result table* (see Figure 6-5).
2. Press **SELECT**.
   A *Parameter label menu* is displayed.
3. Trackball through the *Parameter label menu* to highlight the required label.
4. Press **SELECT** to assign the highlighted parameter label to the measurement.

*The selection of a measurement without pre-defined labels will not display the **Parameter label menu**.*

The assigned measurements may be reviewed in the Worksheet (see page 230). Up to five assigned measurements with the same label can be stored in the patient archive.

△
CAUTION

Only assigned measurements will be saved. Measurements without assignment will be lost when scanning is resumed.



1. **Parameter Label menu**
2. **Selected label**

Assignment

3. **Assigned measurement**

Figure 6-5: Measurement assignment

Controlling the Measurement result table display

The display of the *Measurement result table* can be minimized and moved to prevent the table obscuring parts of the ultrasound image.

Minimizing the Measurement result table

1. Trackball to the symbol on the heading of the *Measurement result table* (see Figure 6-6).
2. Press **SELECT**.
   The *Measurement result table* is minimized to the heading bar.

Repeat step 1 to enlarge the ***Measurement result table****.*

Moving the Measurement result table

1. Trackball to the symbol on the heading of the *Measurement result table* (see Figure 6-6).
2. Press **SELECT** to grab the table.
3. Trackball the *Measurement result table* to a new position.
4. Press **SELECT** to anchor the table.

Alternative: Rotate the assignable **RESULT WINDOW** *to move the* ***Measurement result table*** *from corner to corner on the* ***Acquisition window****.*

1. **Minimize/maximize table**
2. **Move table**

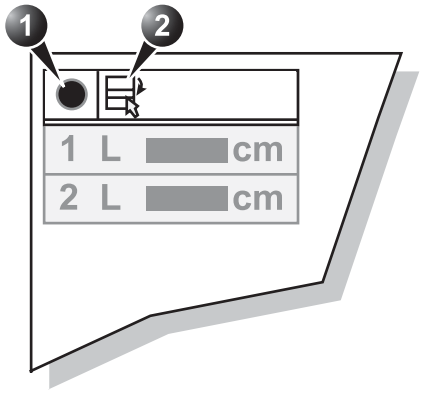
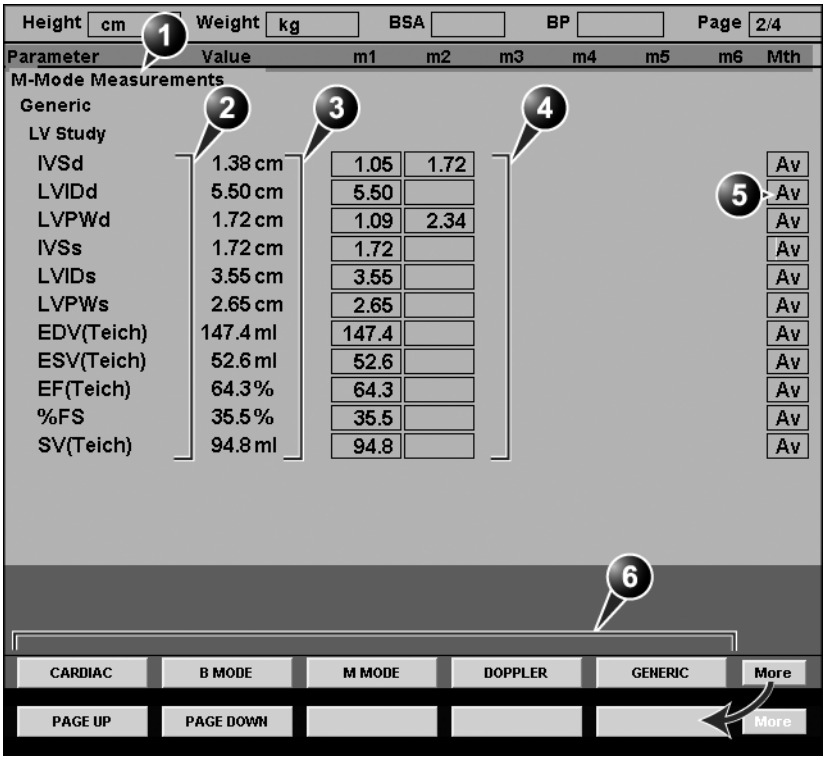


Figure 6-6: Measurement result table display tools

Worksheet

The worksheet function enables the user to review, edit, delete or print data independently of a report. All measurements and calculations taken during the examination can be viewed at any time using the worksheet.

Overview



1. **Measurement type**
2. **Measurement parameter**
3. **Value: Averaging, Max, Min or Last**
4. **Measured / calculated values**
5. **Value type**
6. **Measurement type selection**

Figure 6-7: The Worksheet screen

Using Worksheet

1. Press **WORKSHEET** on the control panel and select the

measurement type (see Figure 6-7).

To scroll through pages

1. Select **PAGE DOWN** or **PAGE UP**.

To select the type of value

1. Trackball to the relevant cell in the *Method column*.
2. Press **SELECT**.
   A pop-up menu is displayed showing the different options available (Figure 6-8).

1. **Average of the measurements taken**
2. **Maximum measurement**
3. **Minimum measurement.**
4. **Last measurement that was taken**

Figure 6-8: The Calculation method options list.

3. Trackball to the required option.
4. Press **SELECT**.
   The value is updated accordingly.

Excluding or including measurements

One or more measurement values from a set of measurements for a parameter can be excluded when doing average calculation.

To exclude a measurement

1. Trackball to the measurement value to exclude.
2. Press **UPDATE MENU**.
   The *Worksheet menu* is displayed.
3. Trackball to **Exclude Value**.
4. Press **SELECT**.

When excluded the measurement display turns grey.

To include a measurement

1. Trackball to the measurement value to include.
2. Press **UPDATE MENU**.
   The *Worksheet menu* is displayed.

3. Trackball to **Include Value**.
4. Press **SELECT**.

Manually changing a value

Individual measured values can be manually changed using the alphanumeric keyboard.

To manually change a value

1. Trackball to the value that is to be changed.
2. Press **SELECT**.
3. Use the alphanumeric keyboard to enter the required value.

*An asterisk indicates that the value has been manually altered. The calculation type is changed to **Edit**.*

To restore automatic calculation

1. Trackball to the relevant cell in the *Method column*.
2. Press **SELECT**.
   A pop-up menu is displayed showing the different calculation options available (Figure 6-8).
3. Press **SELECT**.
   The value is re-calculated according the method selected.

Deleting measurement parameter

1. Trackball to the measurement parameter to delete.
2. Press **UPDATE MENU**.
   The *Worksheet menu* is displayed.
3. Trackball to **Delete Value**.
4. Press **SELECT**.

Chapter 7
Quantitative Analysis

This chapter includes the following information:

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• Accessing the Quantitative analysis package 236
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• Overview 237
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• About the sample area 244
• To generate a trace 244
• Manual tracking of the sample area (dynamic anchored sample area) 245
• Zooming in the Analysis window 246
• Deletion of a trace 247
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• Frame disabling 248
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• Disabling frames in the cineloop windows 248
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Introduction

The quantitative analysis software package is designed for analysis of TVI, Tissue Tracking, Strain, Strain rate and Contrast related raw data.

The main features of these options are:

For TVI:

- Multiple Time -motion trace display from selected points in the myocardium.
- Arbitrary Curved anatomical M-Mode

For Tissue Tracking:

- Multiple tissue displacement trace display from selected segments in the myocardium.
- Arbitrary Curved anatomical M-Mode

For Strain rate:

- Multiple Strain rate (Rate of deformation (s-1)) trace display from selected segments in the myocardium.
- Arbitrary Curved anatomical M-Mode

For Strain:

- Multiple Strain (extend of tissue deformation (%)) trace display from selected segments in the myocardium.
- Arbitrary Curved anatomical M-Mode

For Contrast:

- Time-Intensity analysis from multiple region of interest
- Curve fitting
- Arbitrary Curved anatomical M-Mode

If not otherwise specified, the topics described in this chapter are applicable for both TVI and contrast data.

Accessing the Quantitative analysis package

In replay mode:

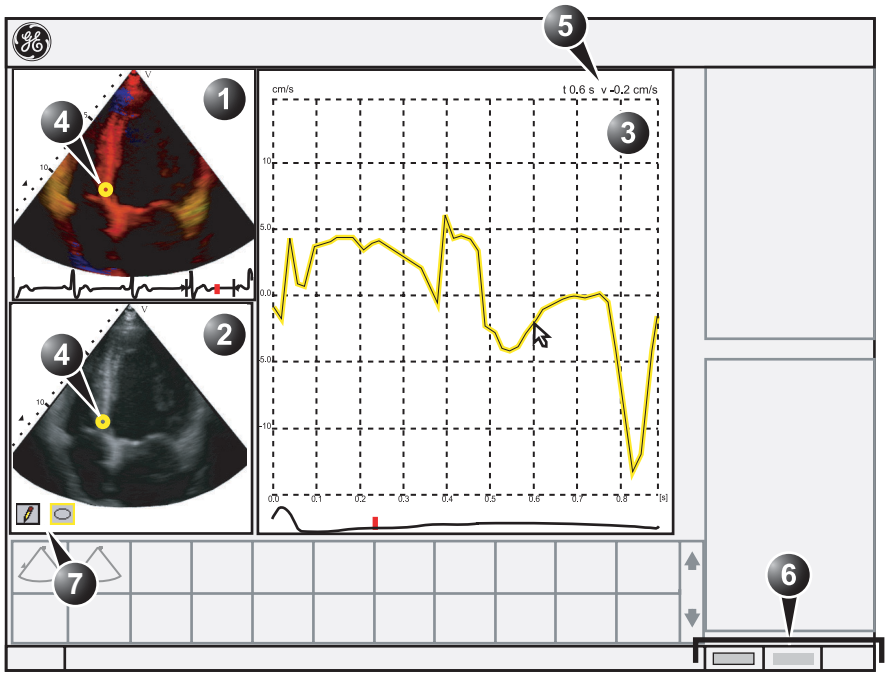
1. Open an examination and recall a TVI or contrast loop.
2. Press the assignable **Q ANALYSIS**.
   The *Quantitative Analysis screen* is displayed (see Figure 7-1).

In live

1. Press **FREEZE**.
   Note: if in 2D mode outside a contrast application, press **ALT** and **MORE** assignable.
2. Press the assignable **Q ANALYSIS**.
   The *Quantitative Analysis screen* is displayed (see Figure 7-1).

Quantitative Analysis window

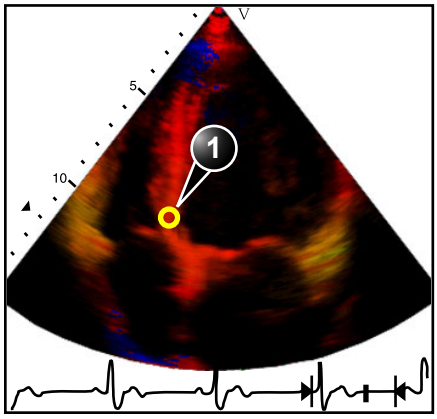
Overview



1. **Color cineloop window**
2. **Tissue cineloop window**
3. **Analysis window**
4. **Sample Area**
5. **Time at cursor position and velocity at cursor position**
6. **Trackball Assignments**
7. **Sample area tools**

Figure 7-1: The Quantitative analysis window (here with TVI data)

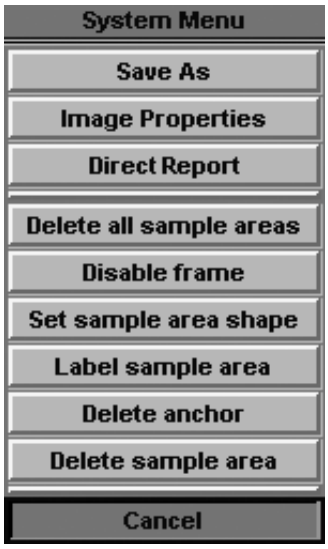
The color cineloop window



Displays TVI, Tissue Tracking, Strain, Strain rate or Angio color-coded data.

Sample area (1):

Indicates sampling position of the velocity (TVI), displacement (Tissue Tracking), percent deformation (Strain), deformation rate (Strain rate) or intensity (Contrast) trace. The sample area is color-coded: the first sample area is yellow, the second green...etc.



a) Shown only when a sample area is selected (pointed at).

b) With Contrast data only.

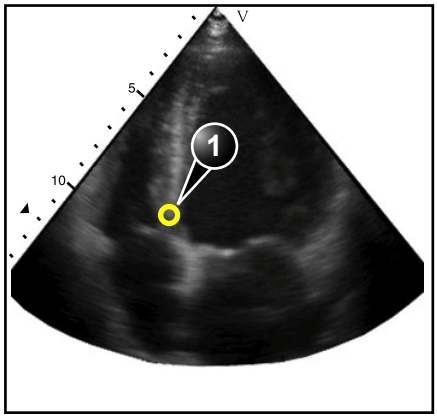
c) Shown only when pointing at an anchored sample area.

The cineloop windows system menu

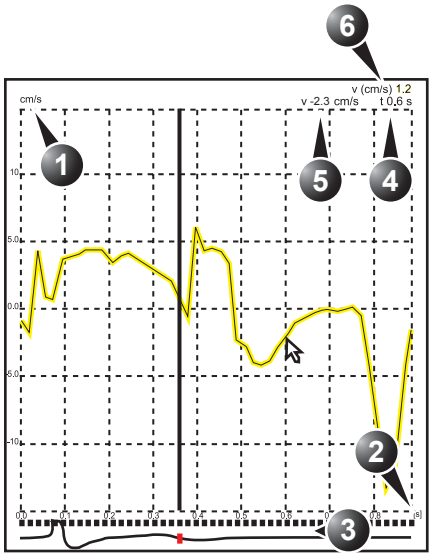
This menu is entered by pressing **UPDATE MENU** when the QA trackball cursor is within one of the *Cineloop windows*.

- **Delete all Sample areas**: removes all traces at once.
- **Disable frame**[b]: the current frame is excluded from the cineloop display.
- **Set Sample area Shape**[a]: enables resizing of a selected sample area by setting height, width and tilt angle. The trackball marker must be pointed at an anchored sample area.
- **Label Sample area...**[a]: set a descriptive name to the sample area. The label is useful for identification of the sample area when exporting data.
- **Delete anchor**[c]: remove anchoring from a dynamic sample area (see also page 244 and page 245).
- **Delete Sample area**[a]: removes selected sample area from the *Cineloop window* and belonging trace in the *Analysis window*. The trackball marker must be pointed at an anchored sample area.
- **Cancel**: exits the *System menu*.

The Tissue cineloop window

	Displays 2D data **Sample area (1):** Indicates sampling position of the velocity (TVI), displacement (Tissue Tracking), percent deformation (Strain), deformation rate (Strain rate) or intensity (Contrast) trace. The sample area is color-coded: the first sample area is yellow, the second green...etc.
	Sample area tools: • : creates a sample area based on freehand drawing. • : creates a sample area with a pre-defined circular/elliptic shape (configurable, see page 250)

The analysis window



TVI:

Displays velocity trace

1. Y axis: velocity scale (cm/s)
2. X axis: Time (s)
3. ECG
4. Time at cursor position
5. Velocity at cursor position
6. Velocity at frame marker position (color coded)

Tissue Tracking:

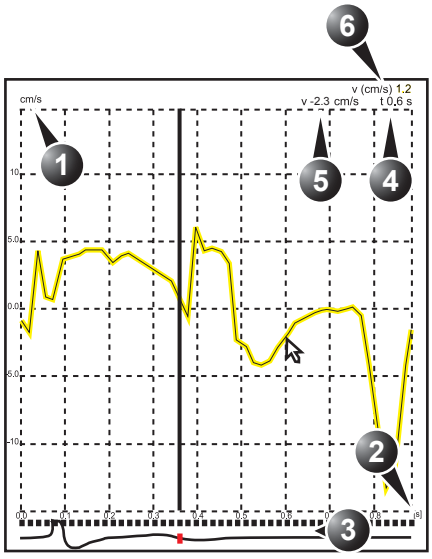
Displays tissue displacement trace

1. Y axis: displacement scale (mm)
2. X axis: time (s)
3. ECG with Tracking start and Tracking end markers
4. Time at cursor position
5. Displacement at cursor position
6. Displacement at frame marker position (color coded)

Strain rate:

Displays Strain rate trace (rate of deformation (s^{-1}))

1. Y axis: s^{-1}
2. X axis: time (s)
3. ECG
4. Time at cursor position
5. Strain rate at cursor position
6. Strain rate at frame marker position



Strain:

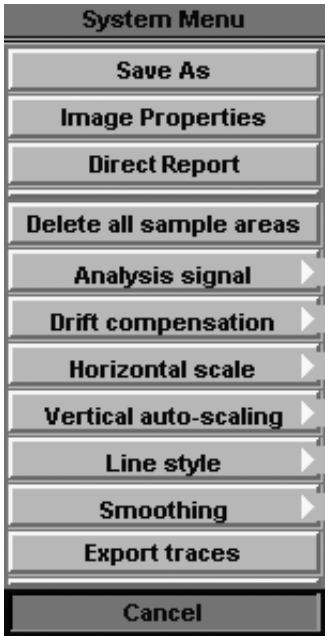
Displays Strain trace (extent of tissue deformation (%))

1. Y axis: percent displacement
2. X axis: time (s)
3. ECG with Strain start and Strain end markers
4. Time at cursor position
5. % deformation at cursor position
6. % deformation at frame marker position (color coded)

Contrast:

Displays time-intensity curve

1. Y axis: Intensity scale (logarithmic) (dB) or linear acoustic units (AU).
2. X axis: Time (s) or dT (s), elapsed time from previous frame.
3. ECG: displays ECG trace, the current frame marker and the start and stop markers for the cineloop.
4. Time at cursor position
5. Intensity (dB or AU) at cursor position
6. Intensity (dB or AU) at frame marker position (color coded)



[a] With contrast data only.

[b] Shown only in zoom mode.

The analysis window system menu:

This menu is entered by pressing **UPDATE MENU** when the QA cursor is within one of the analysis window.

- **Delete all Sample areas**: removes all traces at once.
- **Analysis signal**: toggles trace display between velocity, displacement, strain rate, stain or greyscale intensity curves.
- **Drift compensation**: compensates drifting of strain or Tissue Tracking curves by either resetting the curve to zero at the tracking start point (cycle resetting) or by linear compensation throughout the cycle (linear compensation)
- **Horizontal scale**: set horizontal unit as time (s) or time interval (dt) between frames.
- **Vertical auto-scaling**: selects between full unit range or a range according to the maximum and minimum values of the displayed trace(s).
- **Vertical unit**[a]: toggles between logarithmic (dB) and linear acoustical units (AU).
- **Line style**: selects between solid line only or solid line with square markers at each data point.
- **Smoothing**: smooths the trace displayed by applying a filter over a defined time window. Both the filter type and time window are user-selectable. The type of filter available is depending on the analysis signal displayed.
- **Export traces**: saves trace data in ASCII format, readable in spreadsheet programs. If present, trace data for physiological traces are also exported.
- **Curve fitting**[a]: toggles between Wash-in, Wash-out and off.
- **Unzoom**[b]: restores full analysis window display when in zoom mode.
- **Cancel**: exits the *System menu*.

The Trackball assignments

	QA: Pointing tool in Quantitative analysis mode. **Scroll/Speed:** • When the cineloop is stopped, enables scrolling through the cineloop. • When the cineloop is running, enables control of the cine replay speed.

Generation of a trace

Up to eight traces can be generated.

About the sample area

The sample area can be in three different states:

- **Free sample area**: freely moving sample area (QA cursor) before anchoring.
- **Static sample area**: the free sample area is anchored by pressing **SELECT** on the Trackball area.
- **Dynamic anchored sample area**: the sample area is anchored in two or more frames (see Manual tracking below). In these particular frames, the sample area is displayed with an anchor. The sample area moves smoothly between the anchored positions when playing/ scrolling the cineloop.

The free sample area disappears when the QA cursor is moved over a static anchored frame.

To generate a trace

Trace from a pre-defined sample area

The shape of the pre-defined sample area is configurable (see page 250).

1. If the Trackball assignment is not on QA, press **TRACKBALL** until **QA** is highlighted.
2. If necessary, select the sample area **Shape button** .
3. Trackball to one of the *Cineloop windows*.
   The trackball cursor is changed to a sample area (white circle).
   A preview of the trace is displayed in the *Analysis window*.
4. Press **SELECT** to anchor the sample area.
   In this frame the sample are is marked with an anchor.
   If the cineloop has more than one heart cycle a sample area will also be anchored in the corresponding frame in the next heart cycles.
   The trace is updated accordingly in the *Analysis window*.

The trace and sample area are color-coded. First generated trace is yellow, second green...etc.

The Strain cursor

In Strain and Strain rate modes, the sample area displays a Strain cursor showing the segment along the beam direction that is used for Strain and Strain rate calculations. Make sure

that the Strain cursor is within the myocardium when anchoring the sample area.

Trace from a freehand sample area

1. Select the **Pencil button** .
2. Trackball to one of the *Cineloop windows*.
   The trackball cursor is changed to a cross.
3. Press and hold down the **SELECT** button while drawing a sample area with the trackball.
4. Release the **SELECT** button.
   The sample area is automatically closed.
   The trace is updated accordingly in the *Analysis window*.

Manual tracking of the sample area (dynamic anchored sample area)

The sample area can be moved within the loop to ensure that data in the trace are generated from the same anatomical location during the cyclic motion of the heart.

1. Place a sample area over a region of interest.
   Note the anatomical location of the sample area.
2. Using the **trackball**, scroll to a new frame.
3. Press **TRACKBALL** until the **QA** trackball assignment is selected.
4. Trackball to the sample area.
5. Press **SELECT**.
   The sample area is unanchored.
6. Drag the **sample area** to the corresponding anatomical location in the new frame.
   When the sample area is anchored in more than one frame, linear interpolation is performed, so that the sample area is smoothly moved between the anchored positions in the selected frames when running the cineloop.

In the original frame and this particular frame the sample area is marked with an anchor.

7. Press **TRACKBALL** until the **Scroll** trackball assignment is selected.
8. Using the **Trackball**, scroll through the cineloop and control that the sample area follows the moving anatomical structure.
9. Add anchored sample areas in several frames to obtain a more accurate displacement of the sample area.

To move a dynamic anchored sample area

In these frames the sample area is marked with an anchor.

1. Press **TRACKBALL** until the **Scroll** trackball assignment is selected.
2. Using the **trackball**, browse through the cineloop to display one of the frames where the sample area was anchored.
3. Press **TRACKBALL** until the **QA** trackball assignment is selected.
4. Trackball to the sample area to move, in one of the *Cineloop windows*.
5. Press **SELECT**.
   The sample area is unanchored.
6. Drag the **sample area** to a new location.
7. Press **SELECT** to anchor the sample area to the new location.

Zooming in the Analysis window

1. In the *Analysis window*, press and hold down the **SELECT** key while dragging the trackball cursor to define the zooming area.
2. Release the **SELECT** key.
   The selected area is displayed in the *Analysis window*.

To unzoom

1. Press **UPDATE MENU** in the trackball area on the control panel.
   The *System menu* is displayed.
2. Trackball to **Unzoom**.
3. Press **SELECT**.

Deletion of a trace

The user can delete all traces at once or one at a time.

To delete all traces

1. If necessary, press **TRACKBALL** until the **QA** trackball assignment is selected.
2. Press **UPDATE MENU** in the trackball area on the control panel.
   The *System menu* is displayed.
3. Trackball to **Delete all traces**.
4. Press **SELECT**.

To delete one specific trace

1. If necessary, press **TRACKBALL** until the **QA** trackball assignment is selected.
2. Trackball to the sample area to delete.
3. Press **UPDATE MENU** in the trackball area on the control panel.
   The *System menu* is displayed.
4. Trackball to **Delete trace**.
5. Press **SELECT** to perform deletion.

Frame disabling

Frame disabling excludes the actual frame from the cineloop display. Frame disabling is available only with contrast data. There are two ways to disable a frame.

Disabling frames from the frame marker

To re-enable a frame: Press **SELECT** *on the corresponding frame marker.*

1. Trackball to the frame marker of the frame to disable beneath the *Analysis window* (see Figure 7-2).
2. Press **SELECT** to disable the frame.
   The frame marker turns red.

disabling successive frames at a time

To re-enable successive frames: ***press and hold down the SELECT key*** *while dragging the cursor over the frame markers.*

1. Press and hold down **SELECT** while dragging the cursor over the frame markers of the frames to disable.
   The frame markers turn red.

ECG triggered frame disabling

In a multi-cycle acquisition, the user may deselect all frames in all heart cycles but a selected one. This function can be used for example to select a particular systolic frame for each heart cycle.

1. Scroll through the cineloop to identify the cardiac phase to analyze or identify the cardiac phase on the ECG trace.
2. Trackball to the frame marker of the frame of interest in one of the heart cycles (see Figure 7-2).
3. **Press** **UPDATE MENU**.
   The *System menu* is displayed.
4. Trackball to **ECG triggering**.
5. Press **SELECT**.
   All frames in all heart cycles are disabled except for the selected and corresponding frames in the other heart cycles.

Disabling frames in the cineloop windows

1. Press **UPDATE MENU** in the trackball area on the control panel.
   The *System menu* is displayed.
2. Trackball to **Disable frame**.

3. Press **SELECT**.
   The current frame is disabled and the corresponding frame marker is displayed in red.

Re-enabling all frames

1. Trackball the cursor to the *Frame marker axis*.
2. Press **UPDATE MENU** in the trackball area on the control panel.
   The *System menu* is displayed.
3. Trackball to **Enable all frames**.
4. Press **SELECT**.
   All previously disabled frames are re-enabled.

1. **Analysis window**
2. **Frame marker axis**
3. **Enabled frame (green marker)**
4. **Disabled frame (red marker)**
5. **ECG**
6. **Current frame**

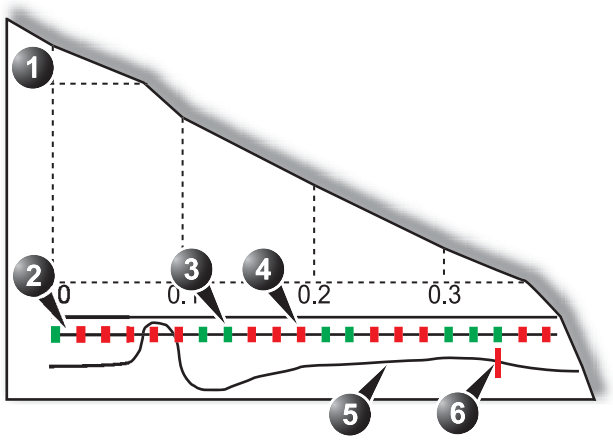


Figure 7-2: Frame disabling

Optimizing sample area

The sample area can be reshaped and labelled.

Reshaping a sample area

There are two ways of modifying a sample area: either from the *Update menu* or by selecting the **SAMPLE SHAPE** assignable.

Reshaping a sample area from the Update menu

1. If necessary, press **TRACKBALL** until the **QA** trackball assignment is selected.
2. Trackball to the sample area to reshape.
3. Press **UPDATE MENU** in the trackball area on the control panel.
   The *System menu* is displayed.
4. Trackball to **Set Sample area shape**.
5. Press **SELECT**.
   A *Dialogue window* is displayed where the user can adjust the height, the width and the angle of the sample area (see Figure 7-3).

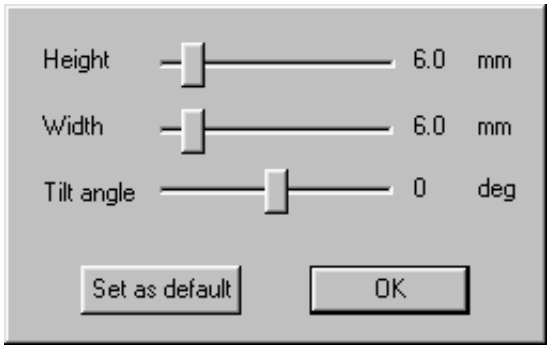


Figure 7-3: The sample area reshaping window

6. **Drag** the sliders to adjust the shape of the sample area as desired.
7. Press **OK** to return to the *Quantitative analysis window* and use the settings for the current analysis only.
   OR

Press **Set as default** to return to the *Quantitative analysis screen* and keep the settings as default.

Reshaping a sample area from the assignables

This procedure allows to reshape either a free sample area or a specific anchored sample area providing that the QA cursor is pointing at the actual sample area.

1. Press the **SAMPLE SHAPE** assignable.
   The Sample shape assignable controls are displayed.
2. Adjust the size and angle of the sample area using the assignable rotaries.
3. If desired press the assignable **SET DEFAULT** to keep the settings as default.

Labelling a sample area

The sample area label is used to identify data associated to the sample area when exporting to a spreadsheet program.

1. If necessary, press **TRACKBALL** until the **QA** trackball assignment is selected.
2. Trackball to the sample area to label.
3. Press **UPDATE MENU** in the trackball area on the control panel.
   The *System menu* is displayed.
4. Trackball to **Label Sample area...**.
5. Press **SELECT**.
   A *Dialogue window* with a free text field is displayed (see Figure 7-4).
6. **Type** a name for the sample area.
7. Press **OK** to return to the *Quantitative analysis screen*.

1. Free text

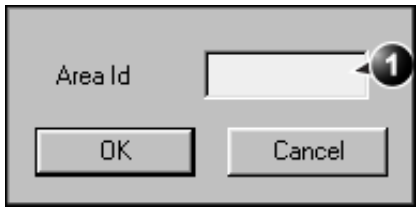


Figure 7-4: The sample area labelling window

Optimizing the trace display

Optimizing the Y-axis

Auto-scaling

The system can be configured to display the full unit range or a range according to the maximum and minimum values of the displayed trace(s) (auto-scaling function). In addition, the auto-scaling function can be set to be live update (updates while the sample area is moved) or delayed (updated when the sample area is anchored).

Setting the auto-scaling function

1. If necessary, press **TRACKBALL** until the **QA** trackball assignment is selected.
2. Trackball to the *Analysis window*.
3. Press **UPDATE MENU** in the trackball area on the control panel.
   The *System menu* is displayed.
4. Trackball to **Vertical auto-scaling**.
5. Press **SELECT**.
   The *Vertical autoscaling menu* is displayed.

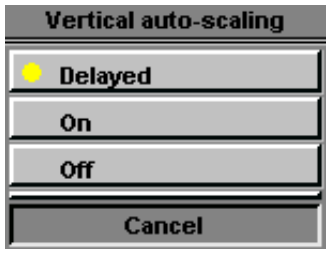


Figure 7-5: The Vertical Auto-scaling menu

6. Trackball to the desired option:
   - **Delayed**: autoscaling takes place after anchoring the sample area.
   - **On**: autoscaling while moving the sample area.
   - **Off**: displays full scale.
7. Press **SELECT**.

Vertical units

Applicable with contrast data only.

When analyzing contrast data, the Y-axis can be set to display either logarithmic scale (dB) or linear, acoustical units (AU) for both tissue intensity (2D) or Angio intensity data.

Selecting the Y-axis unit

1. If necessary, press **TRACKBALL** until the **QA** trackball assignment is selected.
2. Trackball to the *Analysis window*.
3. Press **UPDATE MENU** in the trackball area on the control panel.
   The *System menu* is displayed.
4. Trackball to **Vertical unit**.
5. Press **SELECT**.
   The *Vertical unit menu* is displayed.

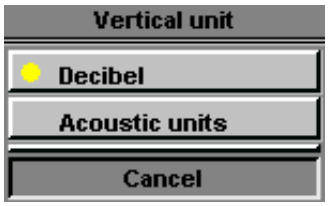


Figure 7-6: The Vertical unit menu

6. Trackball to the desired option.
7. Press **SELECT**.

Trace smoothing

The system can smooth the traces displayed by applying a filter over a defined time window. The type of filter available is depending on the analysis signal displayed.

Smoothing trace(s)

1. If necessary, press **TRACKBALL** until the **QA** trackball assignment is selected.
2. Trackball to the *Analysis window*.
3. Press **UPDATE MENU** in the trackball area on the control panel.

The *System menu* is displayed.

4. Select **Smoothing**.
   The *Smoothing menu* is displayed.
5. Select a smoothing filter.
   The trace display is updated.

Switching modes or traces

The user can toggle between TVI, Tissue Tracking, Strain rate or Strain modes to access to the mode specific controls (soft menu and assignable) or display alternative traces from within a selected mode.

To switch mode

1. Press **MORE**.
2. Select the desired mode (TVI, Tissue Tracking, Strain rate or Strain.
   The *Soft menu* and assignables are updated accordingly.

To switch trace

1. If necessary, press **TRACKBALL** until the **QA** trackball assignment is selected.
2. Trackball to the *Analysis window*.
3. Press **UPDATE MENU** in the trackball area on the control panel.
   The *System menu* is displayed.
4. Trackball to **Analysis signal**.
5. Press **SELECT**.
   The *Analysis signal menu* is displayed.

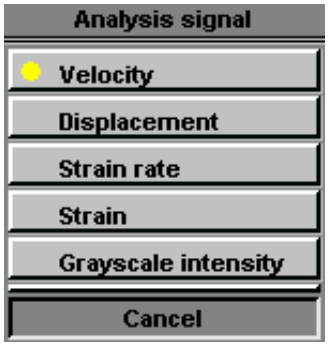


Figure 7-7: The Analysis signal menu

6. Trackball to the desired trace.
7. Press **SELECT**.
   The Analysis window is updated with the selected trace.

Curve fitting analysis

Curve fitting analysis is used to estimate local myocardial perfusion rate using ultrasound contrast agents.

The analysis is based on two algorithms:

- **Wash-in curve fitting**: find and estimate local perfusion rate using contrast agent.

  Exponential wash-in is described by the function:

  $y(t)=A[1-e^{-kt}]+B$, where:

  - **A** (dB or AU) is the intensity from the contrast agent.
  - **B** (dB or AU) is the intensity at time t = 0 (defined as the time of left marker). This corresponds to the tissue (baseline) signal if no contrast is present at the selected starting point.
  - **k** (1/s) is a time constant.

Note that A+B = contrast + tissue = plateau level.

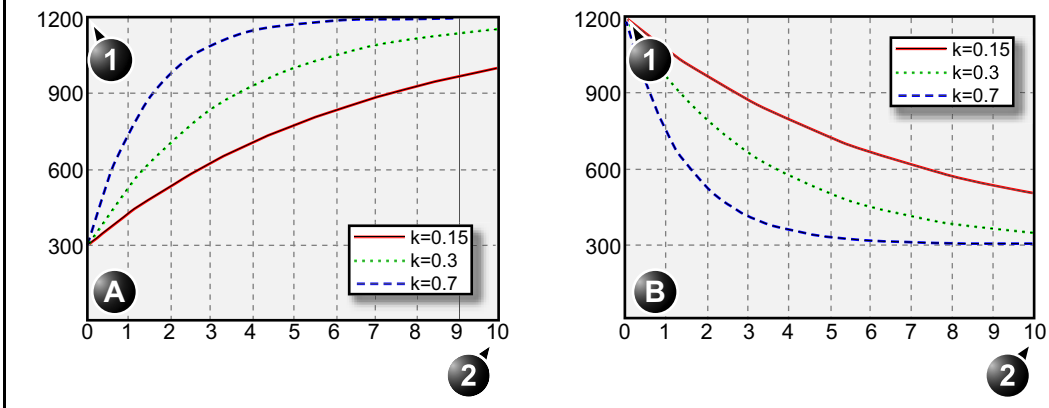
- **Wash-out curve fitting**: find and estimate the wash-out rate of contrast agent locally (e.g. LV or myocardium).

  Exponential wash-out is described by the function:

  $y(t)=Ae^{-kt}+B$, where:

  - **A** (dB or AU) is the intensity from the contrast agent.
  - **B** (dB or AU) is the intensity from the tissue = baseline signal.
  - **k** (1/s) is a time constant.

Note that A+B is the initial intensity level.



1. **Intensity (AU)**
2. **Time (s)**

Figure 7-8: Curve fitting examples, A) wash-in, B) wash-out A=900 AU, B=300 AU for all curves

Wash-in curve fitting analysis

Overview

The purpose of wash-in curve fitting analysis is to find and estimate local perfusion rate using contrast agent. There are two methods to obtain this information:

- Use the Real-time Myocardial Contrast application (see page 202) with low transmit power (MI 0.1). Applying **Flash** will destroy most or all contrast within the imaging plane. The period of low power imaging immediately following the flash will contain the information on how fast contrast agent washes into different segments of the myocardium. By storing data 5 to 10 seconds after Flash and performing curve fitting to this data set, the user can explore myocardial perfusion.
- Use the myocardial Contrast application in triggered mode (page 194). This imaging mode is destructive for the contrast agent, and the interval between each frame determines the image intensity. Vary the triggering interval to obtain information regarding how fast the contrast agent washes into the myocardium after destruction.

Performing wash-in curve fit

From a contrast examination in Quantitative analysis:

1. Disable frames that are significantly different (i.e. because of respiration or probe movements), see page 248.

Up to eight different sample areas may be generated in the myocardium.

2. Trackball the sample area over the myocardium in one of the *Cineloop windows*.
3. Press **SELECT** to anchor a sample area in the myocardium.
4. If desired, reshape the sample area as described on page 250.

Refer to 'Manual tracking of the sample area (dynamic anchored sample area)' on page 245 for further details

5. Because of heart motion, the sample area in each frame has to be adjusted manually to be located inside the myocardium (Manual tracking of the sample area).
   The signals originating from the heart cavities are typically 10 to 20 times stronger than the signals from the myocardium, and will have a major effect on the averaging of signals in the sample area.
6. Browse through the cineloop to ensure that the sample area is in the same anatomical position in all frames.

7. Rotate the **HORIZONTAL SWEEP** assignable and scroll through the cineloop to visualize a specific part of the data, typically the region immediately after Flash.
8. Rotate the **LEFT MARKER** and **RIGHT MARKER** assignables to apply curve fitting to a specific region.
9. Trackball to the Analysis window.
10. Press **UPDATE MENU** in the trackball area on the control panel.
    The *System menu* is displayed.
11. Trackball to **Curve fitting**.
12. Press **SELECT**.
    The *Curve fitting menu* is displayed.

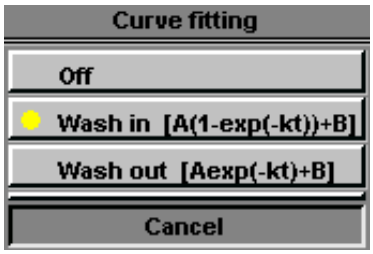
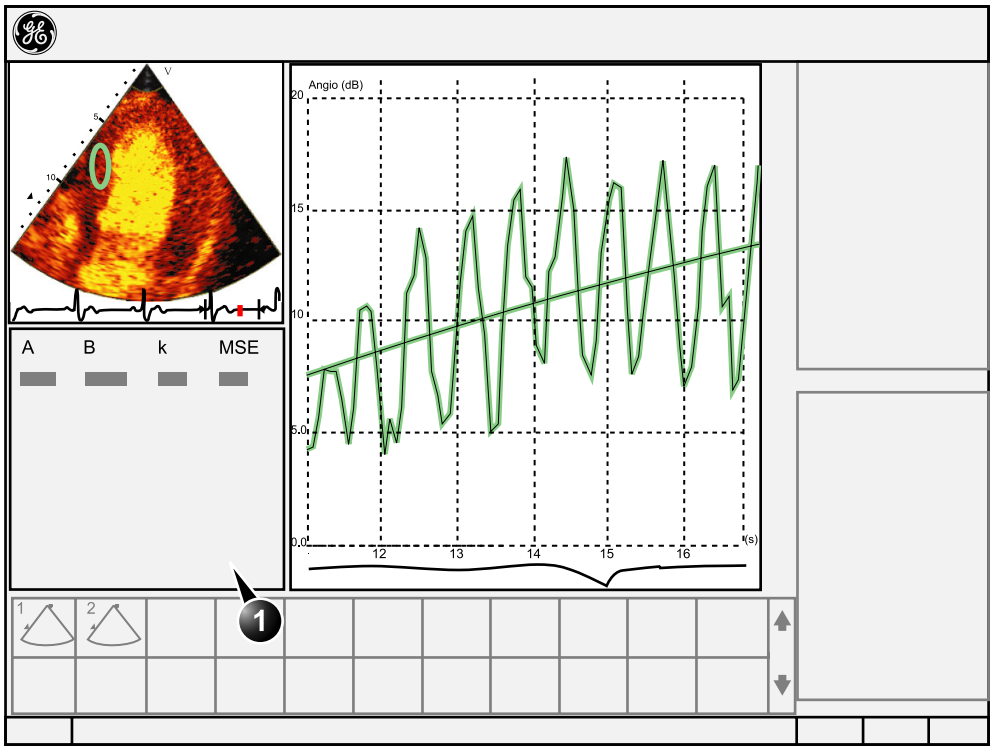


Figure 7-9: The Curve fitting menu

13. Trackball to **Wash-in**.
14. Press **SELECT**.
    The Wash-in curve is displayed in the *Analysis window* (see Figure 7-10).



1. **Parameter window**

Figure 7-10: Wash-in curve fit of Real Time MC data

Wash-in curve fitting using varying triggering intervals

If the data set contains frames with uneven time intervals, e.g. triggered images with increasing triggering intervals, it is possible to plot the data using the time interval (dt) on the X-axis.

1. Disable unwanted frames. Curve fitting will be performed using all enabled frames.
2. Trackball the sample area over the myocardium in one of the *Cineloop windows*.

The frame disabling procedure is explained on page 248.

Up to eight different sample areas may be generated in the myocardium.

See page 245 for more information on sample area manual tracking.

3. Press **SELECT** to anchor a sample area in the myocardium.
4. Repeat steps 2 and 3 if other sample areas are desired.
5. If desired, reshape the sample area as described on page 250.
6. Perform **manual tracking** of the sample areas on all frames to ensure that the sample area is inside the myocardium.
7. Trackball to the *Analysis window*.
8. Press **UPDATE MENU** in the trackball area on the control panel.
   The *System menu* is displayed.
9. Trackball to **Horizontal scale**.
10. Press **SELECT**.
    The *Horizontal scale menu* is displayed.
11. Trackball to **dT scaling**.
12. Press **SELECT**.
    The X-axis in the *Analysis window* is updated accordingly.
13. Press **UPDATE MENU** again.
14. Trackball to **Curve fitting**.
15. Press **SELECT**.
    The *Curve fitting menu* is displayed.

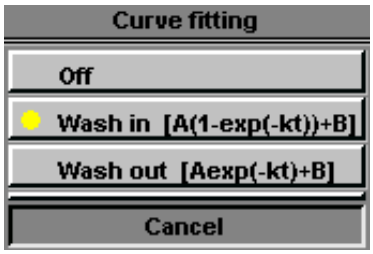
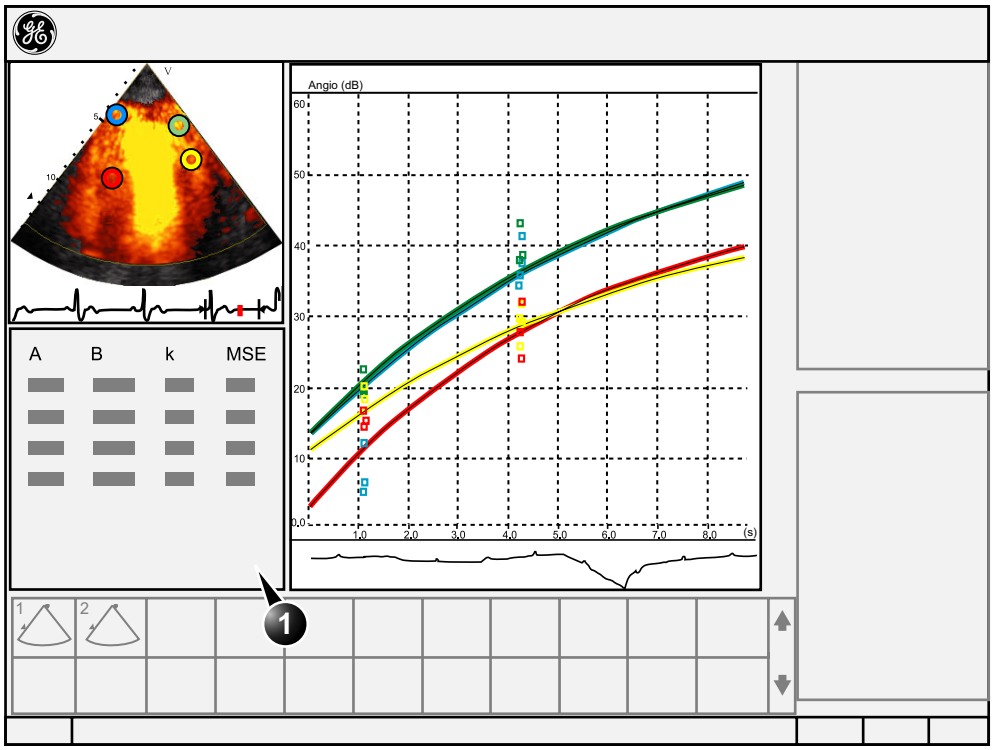


Figure 7-11: The Curve fitting menu

16. Trackball to **Wash-in**.
17. Press **SELECT**.
    The Wash-in curve is displayed in the *Analysis window*.



1. **Parameter window**

Figure 7-12: Wash-in curve fitting after varying triggering interval

Wash-out curve fitting analysis

Overview

The purpose of wash-out curve fitting analysis is to find and estimate a local wash-out rate. The analysis may be used for wash-out of contrast from LV or myocardium.

Performing wash-out curve fitting

From a contrast examination in Quantitative analysis:

1. Disable frames that are significantly different (i.e. because of respiration or probe movements), see page 248.
2. Trackball the sample area over the myocardium in one of the *Cineloop windows*.
3. Press **SELECT** to anchor a sample area in the myocardium.

Up to eight different sample areas may be generated in the myocardium.

4. If desired, reshape the sample area as described on page 250.
5. Because of heart motion, the sample area in each frame has to be adjusted manually to be located inside the myocardium (Manual tracking of the sample area).
   The signals originating from the heart cavities are typically 10 to 20 times stronger than the signals from the myocardium, and will have a major effect on the averaging of signals in the sample area.

Refer to 'Manual tracking of the sample area (dynamic anchored sample area)' on page 245 for further details.

6. Browse through the cineloop to ensure that the sample area is in the same anatomical position in all frames.
7. Rotate the **HORIZONTAL SWEEP** assignable and scroll through the cineloop to visualize a specific part of the data.
8. Rotate the **LEFT MARKER** and **RIGHT MARKER** assignables to apply curve fitting to a specific region.
9. Trackball to the *Analysis window*.
10. Press **UPDATE MENU** in the trackball area on the control panel.
    The *System menu* is displayed.
11. Trackball to **Curve fitting**.
12. Press **SELECT**.
    The *Curve fitting menu* is displayed.

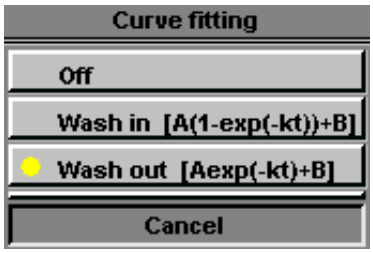


Figure 7-13: The Curve fitting menu

13. Trackball to **Wash-out**.
14. Press **SELECT**.
    The Wash-out curve is displayed in the *Analysis window* (see Figure 7-14).

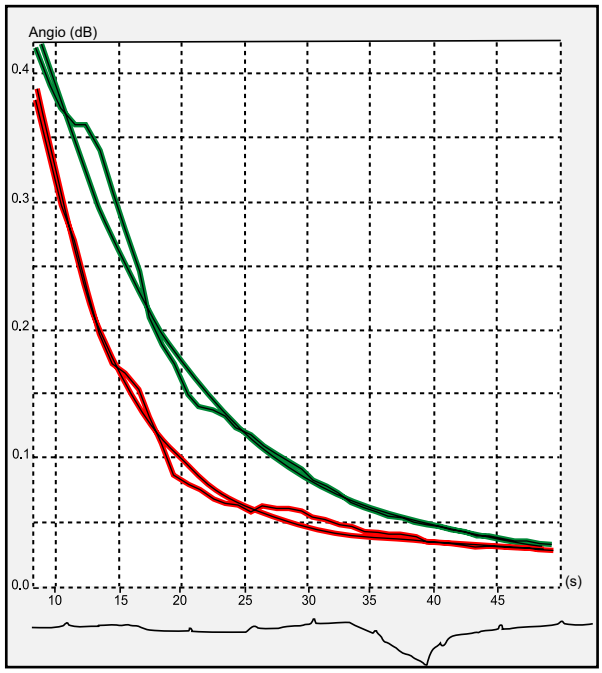


Figure 7-14: Wash-out curve fit of two sample regions in an in-vitro experiment

Anatomical M-Mode

Introduction

M-Mode applied to TVI, Tissue Tracking, Strain rate, Strain or intensity data (Contrast) calculates and color/codes data accordingly along a path drawn by the operator.

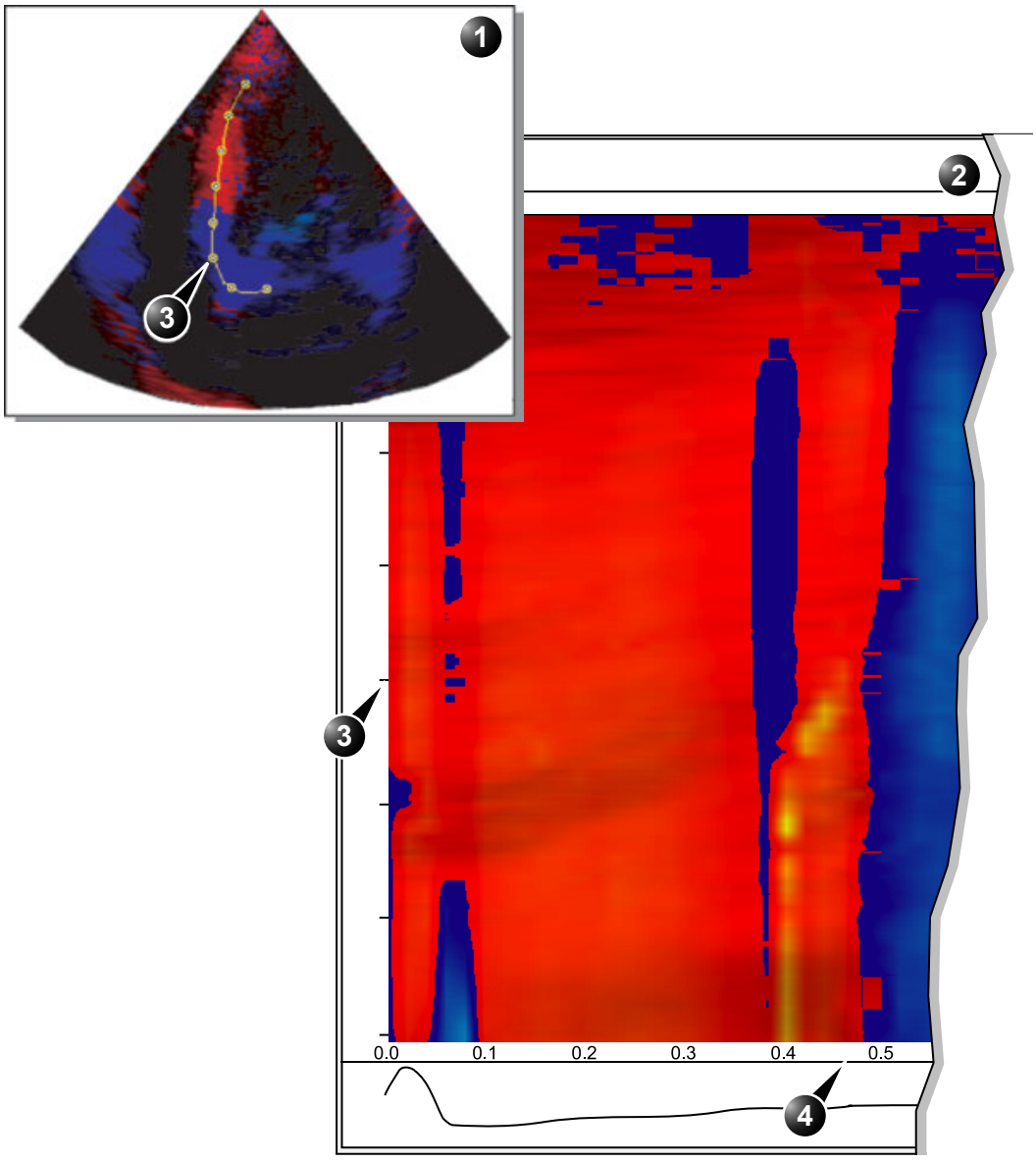
Using Anatomical M-Mode

1. Press the **CAMM** assignable.
2. In one of the *Cineloop windows*, trackball to the region from where to start the sampling path.
3. Press **SELECT** to anchor the first point of the path.
4. Trackball to the location for the next anchoring point of the path.

To edit a path under construction, ***trackball backward*** *and retrace the path.*

5. Press **SELECT** to anchor the point.
   A path with two anchor points will give a straight anatomical M-Mode profile. By creating more than two anchor points, the user can bend the path and obtain a curved anatomical M-Mode profile.
6. To end the trace press **SELECT** twice (double clicking).
   The color-coded display of the corresponding data calculated along the path is shown in the *Analysis window* (see Figure 7-15).

Rotate **HORIZ. SWEEP** *and scroll through the cineloop to optimize the display to the portion of interest.*



1. **Cineloop window**
2. **Analysis window**
3. **Path anchor point**
4. **Time scale**

Figure 7-15: The anatomical M-Mode display (here TVI data)

Optimizing Anatomical M-Mode

Edition of the curve

The drawn Anatomical M-Mode path can be edited by moving the anchor points.

To move an anchor point

1. Trackball to anchor point to move.
2. Press **SELECT**.
3. Trackball the anchor point to a new position.
4. Press **SELECT** to anchor the point to its new location.

Chapter 8
Archiving

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Introduction

During an examination, the operator stores data, images and cineloops for immediate purposes. The Vivid 7/Vivid 7 PRO ultrasound unit includes an integrated patient archiving system for data and image storage.

△
CAUTION

Do not use the internal harddrive for long-term image storage.

The Vivid 7/Vivid 7 PRO ultrasound unit enables also storing of data and images to external databases (EchoServer, Magneto Optical (MO) disk or CD-R). The patient and image archives are set by the selected dataflow (see page 424 about available dataflows and default dataflow selection).

Storing images and cineloops

DICOM images are stored to formatted Magneto Optical disks separately from patient data.

Images and cineloops that are stored during a current examination are displayed as thumbnails on the clipboard (see Figure 8-1). When an image is stored, all the additional information that is displayed is saved with it (e.i. probe and application selected, image setting, annotations or measurements...).

The image archive is set by the dataflow selected (see page 424 about available dataflows and default dataflow selection).

△
CAUTION

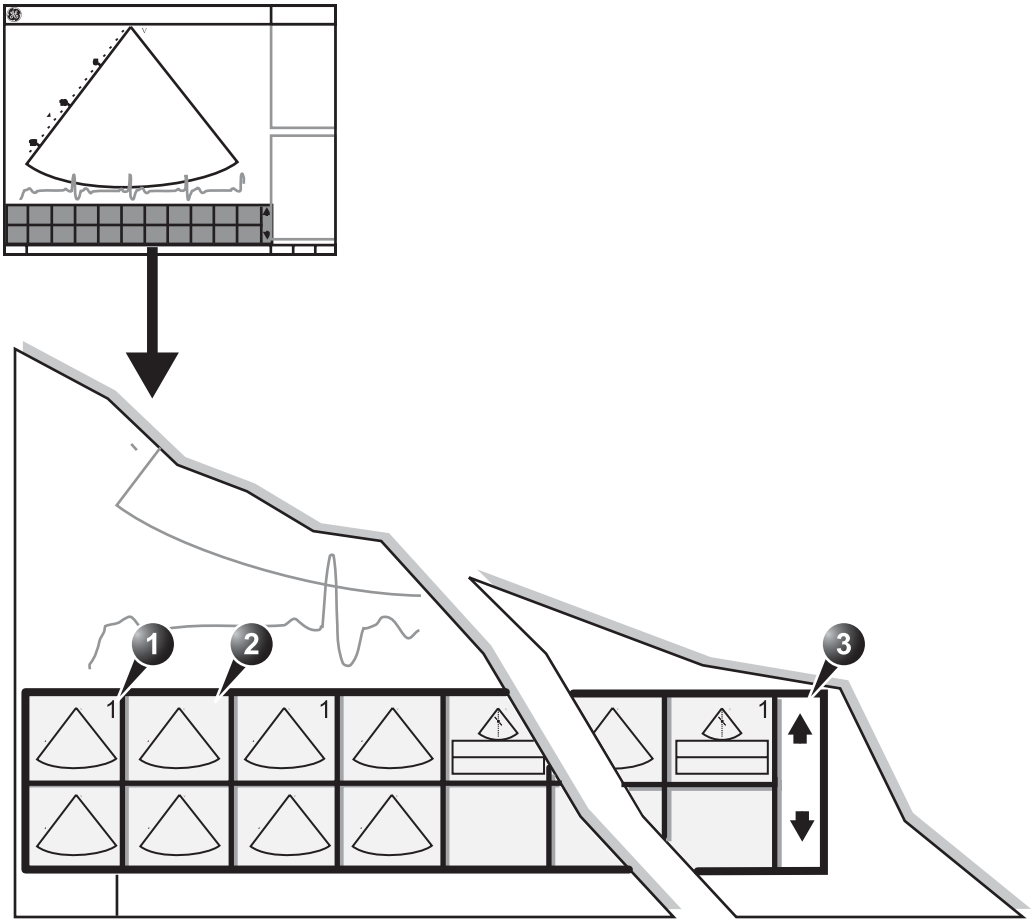
Do not use the internal harddrive for long-term image storage.

A formatted (see page 435) Magneto Optical Disk is recommended for image archive.

△
CAUTION

If working off-line with a dataflow pointing to a DICOM server, the images stored during the examination will have to be manually resent in the DICOM spooler (page 325) when reconnecting the unit. Resend all jobs that are failed or on hold (See page 325 for more information on DICOM spooler.).

In addition, stored images and cineloops can be saved to a removable media in the standard formats JPEG, AVI (cineloop) and DICOM (see page 274).



1. **Single image stored**
2. **Cineloop stored Scrolling tool**
3. **Scrolling tool**

Figure 8-1: The Clipboard on the scanning screen

Storing an image

Images are displayed chronologically on the clipboard.

1. While scanning in any mode, press **FREEZE**.
2. Trackball to scroll through the cineloop and select the required image.
3. Press **STORE**.
   The image is stored and a thumbnail is displayed on the clipboard. The number “1” on the thumbnail image indicates that the image stored is a single frame (see Figure 8-1, page 272).

Storing a cineloop

A cineloop is a sequence of images recorded over a certain time frame. The time frame can be adjusted to cover one or more heart cycles. The stored cineloops are displayed chronologically on the clipboard. Cineloops can be stored at any time during the scanning session. The user can choose to preview the cineloop before storage or save the cineloop directly as described below.

Preview and storage of a cineloop

1. While scanning in any mode, press **FREEZE**.
2. Press the Assignable **CINELOOP**.
3. Determine the best cineloop to store using the assignables (see page 62 for further information on cineloop operation).
4. Press **STORE**.
   The cineloop is stored and a thumbnail is displayed on the clipboard (Figure 8-1, page 272).

Direct storage of a cineloop

Depending on whether the system has been configured to enable or disable the **Preview Loop before store** function (see page 397), the following procedures enable the cineloop to be stored directly.

Storing cineloop without preview

The function **Preview Loop before store** is disabled (see page 397).

1. While scanning, press **STORE**.
   The last valid cineloop is stored in the archive and a thumbnail is displayed on the clipboard (Figure 8-1, page 272).
   Scanning resumes immediately.

Storing cineloop with preview

The function **Preview Loop before store** is enabled (see page 397).

1. While scanning, press **STORE**.
   The last valid cineloop is previewed on the screen (but not stored).
2. If desired, press **CINELOOP** and adjust the cineloop to be stored using the assignables (see page 62).
3. Press **STORE** to save the cineloop.
   A thumbnail is displayed on the clipboard (Figure 8-1, page 272).

Saving stored images and cineloops to a standard format

Stored images and cineloops can be saved to a formatted (see page 436) MOD or a CD-R in the following standard formats:

- **Still images**: JPEG, DICOM and RawDICOM (Raw data + DICOM)
- **Cineloops**: AVI, DICOM and RawDICOM (Raw data + DICOM)

Images can also be stored as MPEG format on a CD-R using the Export function as described on page 276.

Procedure:

1. Trackball to the required image or loop icon on the clipboard.
2. Press **SELECT**.
   The selected image is displayed.
3. Press **MENU** on the control panel.
   The *System menu* is displayed.

Figure 8-2: The System menu

4. Trackball to **Save as**.
5. Press **SELECT**.
   The *Save as menu* is displayed.

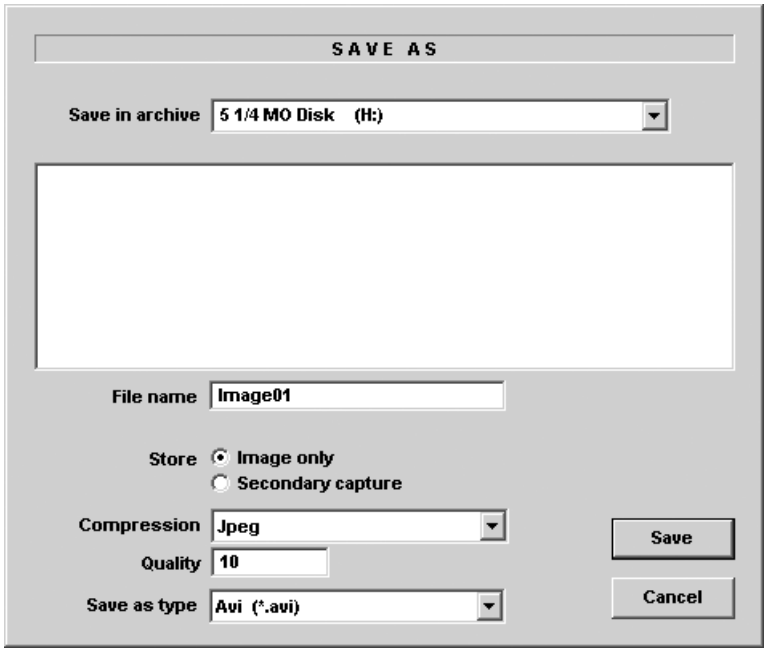


Figure 8-3: The Save as menu

6. Select the desired removable media from the *Save in archive pull-down menu*.
7. Enter a file name in the *File name field*.

If the image or cineloop is saved as DICOM or RawDICOM the file name is automatically generated to follow the DICOM standard.

8. Select between:
   - **Store image only**: saves the image or cineloop only.
   - **Store secondary capture**: creates a still image of the image area and the Title bar.

   The secondary capture is not available when saving images as DICOM or RawDICOM.
9. Select the image compression type (JPEG or RIe) or no compression.
10. Enter in the desired **Image quality** (between 10 and 100). A high quality setting will give a lower compression.
11. In the *Save as type field* select one of the following formats:
    - **RawDICOM**: saves the still image or cineloop in both GE raw format and DICOM format.
    - **DICOM**: saves the still image or cineloop in pure DICOM format.
    - **JPEG**: saves a still image in JPEG format.
    - **AVI**: saves the cineloop in AVI format.
12. Press **Save**.
    A file is saved in the selected archive.

MPEGvue

MPEGvue enables the user to convert ultrasound images to MPEG format and create a CD that is readable from a regular computer.

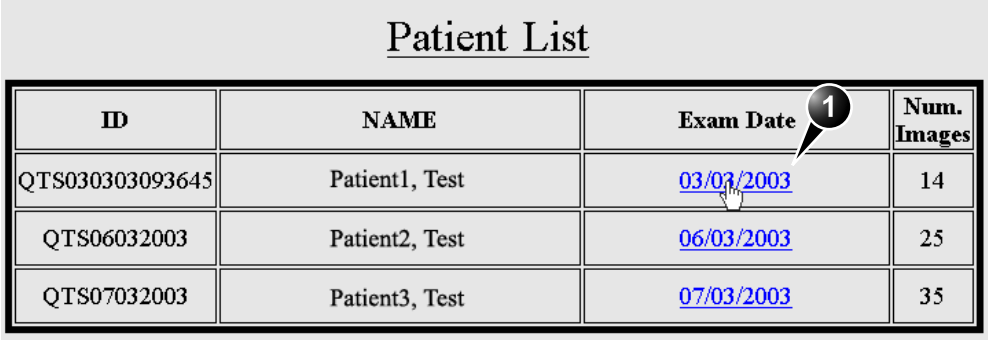
Creating a MPEGvue CD

1. Insert a formatted (see page 67) CD-R in the drive.
2. Export the actual patient records as described on page 315.
   Make sure to select **MPEGvue** as the export destination.

Reading MPEGvue CD

MPEGvue CD can be read form any computer with Windows 98/2000/XP, provided that DirectX 8.1 or later and Windows Media Player 7.1 or later are installed.

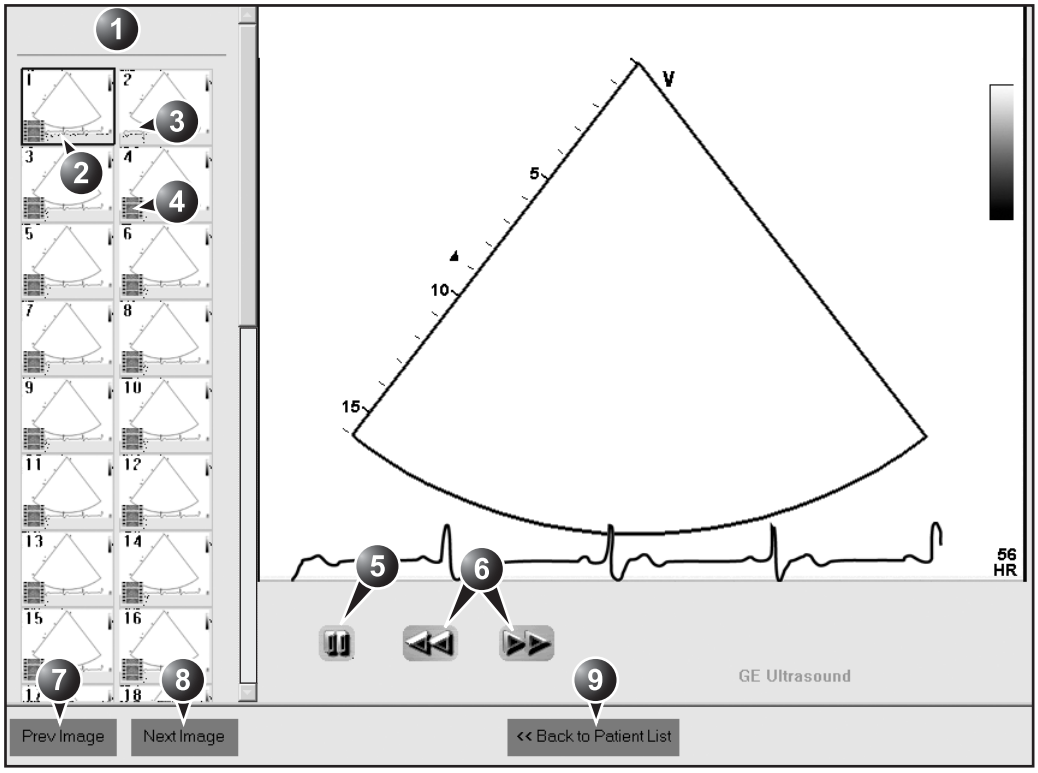
1. Insert the MPEGvue CD in the computer CD drive.
   The *MPEGvue Patient list* is displayed.



1. Select the examination date.

Figure 8-4: The MPEGvue Patient list

2. Select the desired examination date to display the belonging images.
   The *MPEGvue screen* is displayed (Figure 8-5).



1. **Clipboard: select the image to display**
2. **Selected image**
3. **Single frame image**
4. **Cineloop**
5. **Freeze/run cineloop**
6. **Scrolling tool when in Freeze**
7. **Display previous image**
8. **Display next image**
9. **Display the MPEGvue patient list**

Figure 8-5: The MPEGvue screen

Retrieving and editing archived information

Locating a patient record

To create an operator ID, see page 449.

1. Press **ARCHIVE** on control panel.
   If the unit is password protected a *Log In window* (Figure 8-6) will appear asking for user ID, and password.

1. Select the operator

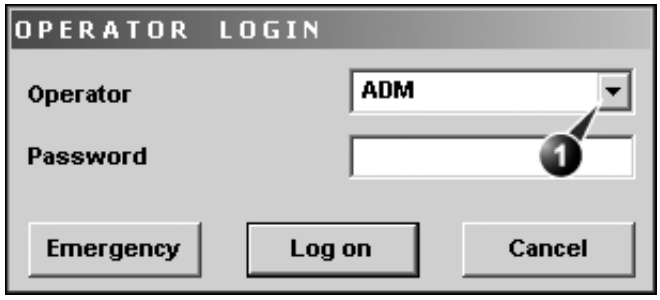


Figure 8-6: The Operator login window

The unit can be configured to automatically generate a patient ID (see page 437)

2. Press **Log on** when completed.
   The *Search/Create patient window* is displayed (Figure 8-7).
3. Type the patient **Last Name**, and/or **ID**.

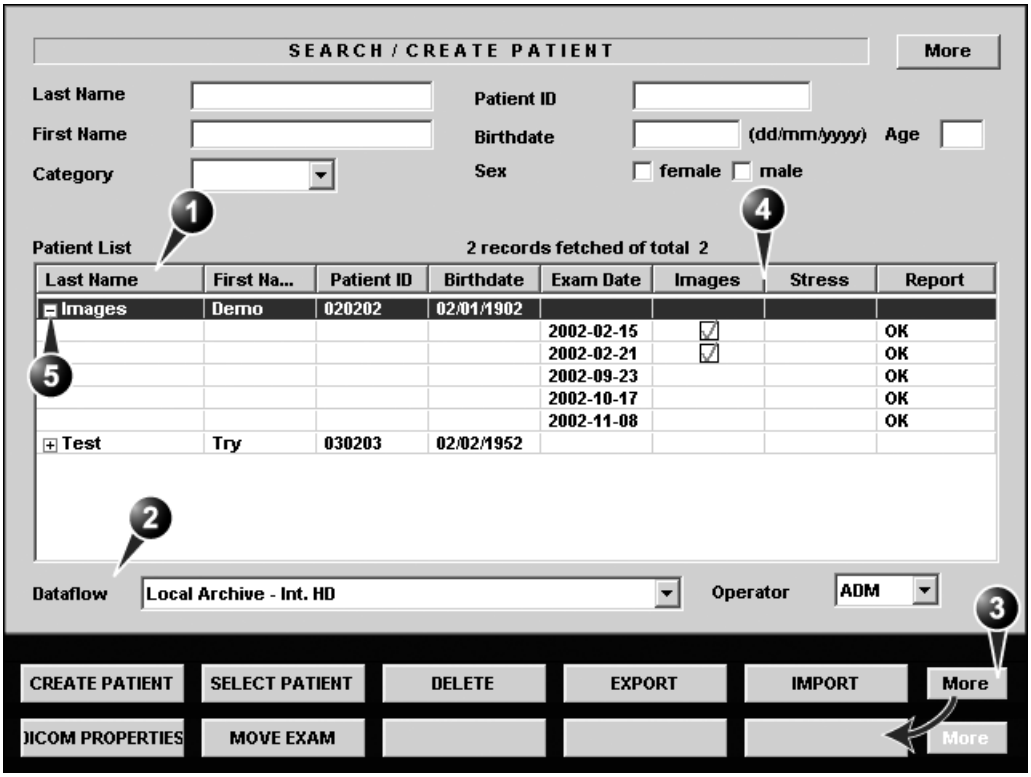
△
CAUTION

Do NOT use '\' or '^' in patient information fields, as these characters might cause problems with some DICOM devices.

The automatic searching tool displaying matching patient information in the Patient list can be turned off (see page 437)

When default configured, the system automatically searches to see if the patient is already in the database. The result of this search is displayed in the *Patient list field.*

4. Trackball to the actual patient and press the Trackball **SELECT** key.
   The patient record is highlighted.
5. Press **SELECT PATIENT**
   Or
   Press **[+]** in front of the actual patient record and select the desired examination.
   The *Examination List window* for the actual patient is displayed (refer to Figure 8-9).



1. **Press one of the headings to sort the list accordingly.**
2. **Select new archive and other pre-defined services**
3. **Extended menu**
4. **Select the column heading border and drag to adjust column width**
5. **Expended Patient record displaying belonging examinations**

The Search/Create patient window may be slightly different depending on the Dataflow selected

Figure 8-7: The Search/Create Patient window

Advanced search

The list of searching filters may vary depending on the Dataflow selected

To restrain the search to a specific patient group, one or more filters may be applied to the search. The table below shows the filters applicable to a patient search:

Searching filter
Echolab
Diag. code
Date of birth (time span)
Examination date (time span)
Current date
Images
Stress examinations
Report

Searching with filter:

The unit can be configured to display the Advanced search tool as default (see page 437)

1. Trackball to the **More** button in the *Search/Create Patient window*.
2. Press **SELECT** on the control panel.
   The *Search/Create Patient window* is extended displaying the searching filters (see Figure 8-8).
3. Type the information in the required searching filter field.
4. Type the patient **Last Name**, and/or **ID**.
   The matching data is displayed in the *Patient list* when the automatic search function is turned on.

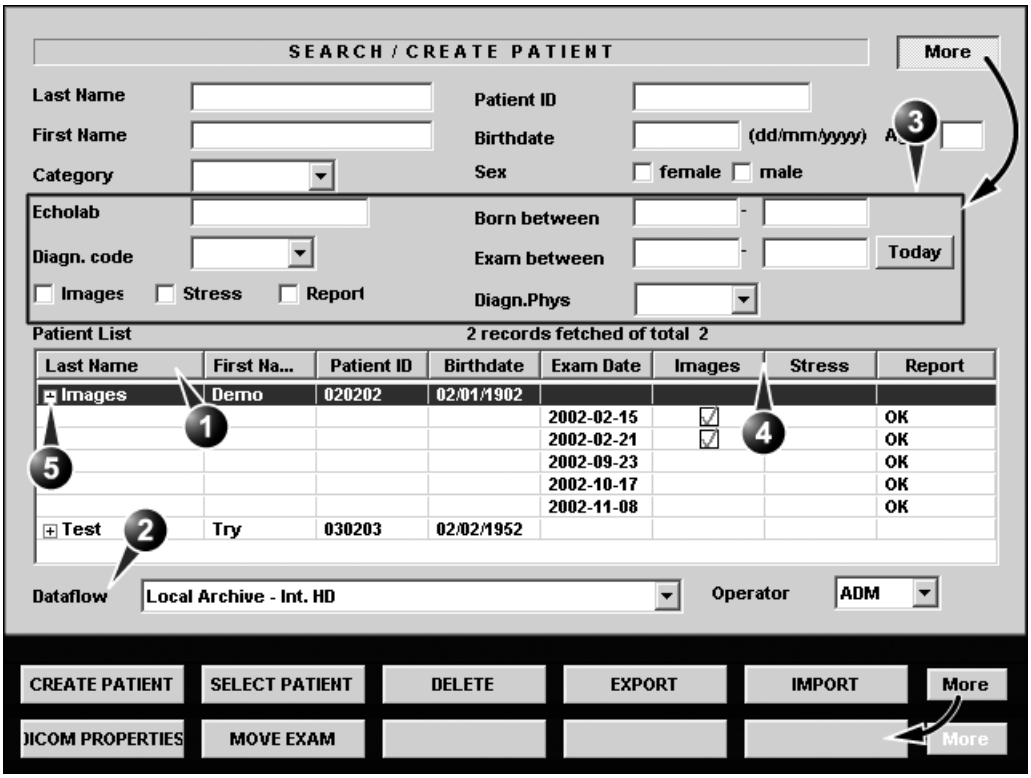
Sorting data

The search result can be sorted according to the fields displayed in the patient list, in ascending or descending order.

To sort data:

1. In the *Patient list field*, Trackball to the field header by which the sort is to be performed (Figure 8-8, page 282).
2. Press **SELECT** on the control panel.
   The patient list is sorted in ascending order according to the field selected.

3. Press **SELECT** once more.
   The patient list is sorted in descending order according to the field selected.



1. **Press one of the headings to sort the list accordingly.**
2. **Select new archive and other pre-defined services**
3. **The system can be configured to display the Advanced search tool as default (see page 437)**
4. **Select the column heading border and drag to adjust column width**
5. **Expended Patient record displaying belonging examinations**

The Search/Create patient window may be slightly different depending on the Dataflow selected.

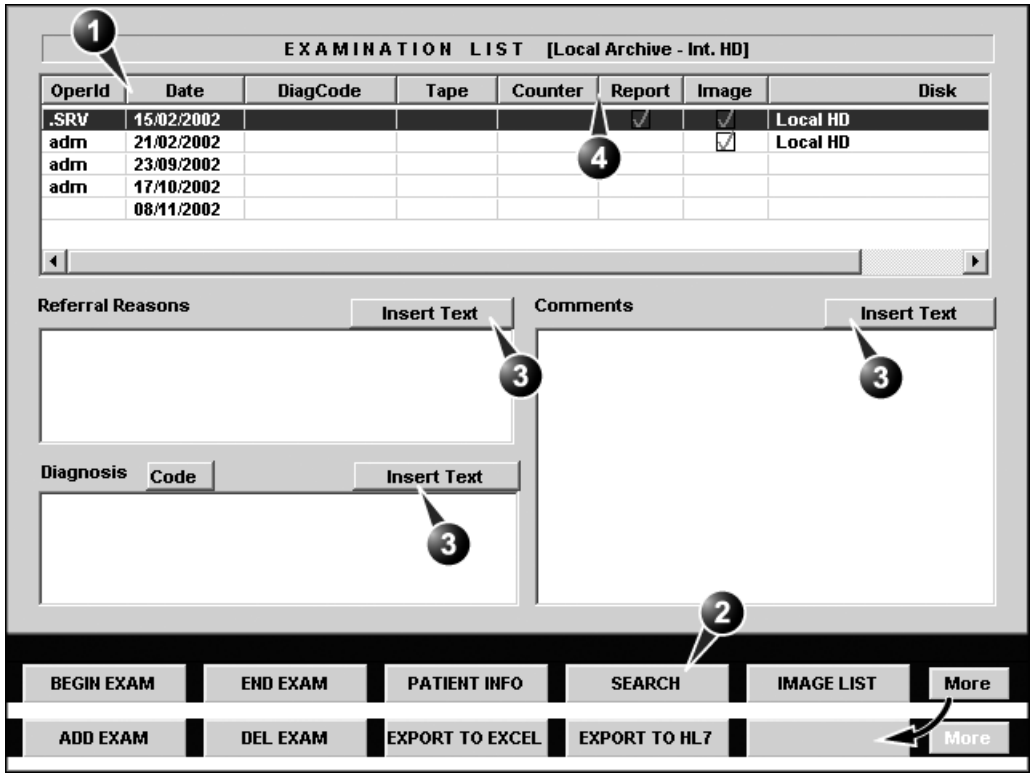
Figure 8-8: The extended Search/Create Patient window

Selecting a patient record and editing data in the archive

After locating the patient in the database (see page 279 page 282), the user must select the patient record, to be able to review and edit archived data.

Selecting a patient record from the patient list

1. In the *Search/Create patient window*, trackball to the actual patient and press the Trackball **SELECT** key.
   The patient record is highlighted.
2. Press **SELECT PATIENT**.
   The *Examination List window* is displayed showing previous examinations and diagnosis information related to the selected patient (see Figure 8-9).



1. **The information displayed in the Patient list is configurable (see page 437).**
2. **Go to Search/Create Patient window (see page 280)**
3. **Insert pre-defined text in the Comment field**
4. **Select the column heading border and drag to adjust column width**

Figure 8-9: The Examination list window

Editing Referral Reasons, Comments and Diagnosis

The user can edit the actual text in the *Examination List window* using the alphanumeric keyboard and by inserting pre-defined text input.

Text edition

1. In the *Examination list window* (Figure 8-9), trackball to the required field.
2. Press **SELECT**.
3. Using the alphanumeric keyboard, edit the information.
4. Press **ARCHIVE** on the control panel to quit the archive.

Use the Arrow keys to move text marker.

Inserting pre-defined text input

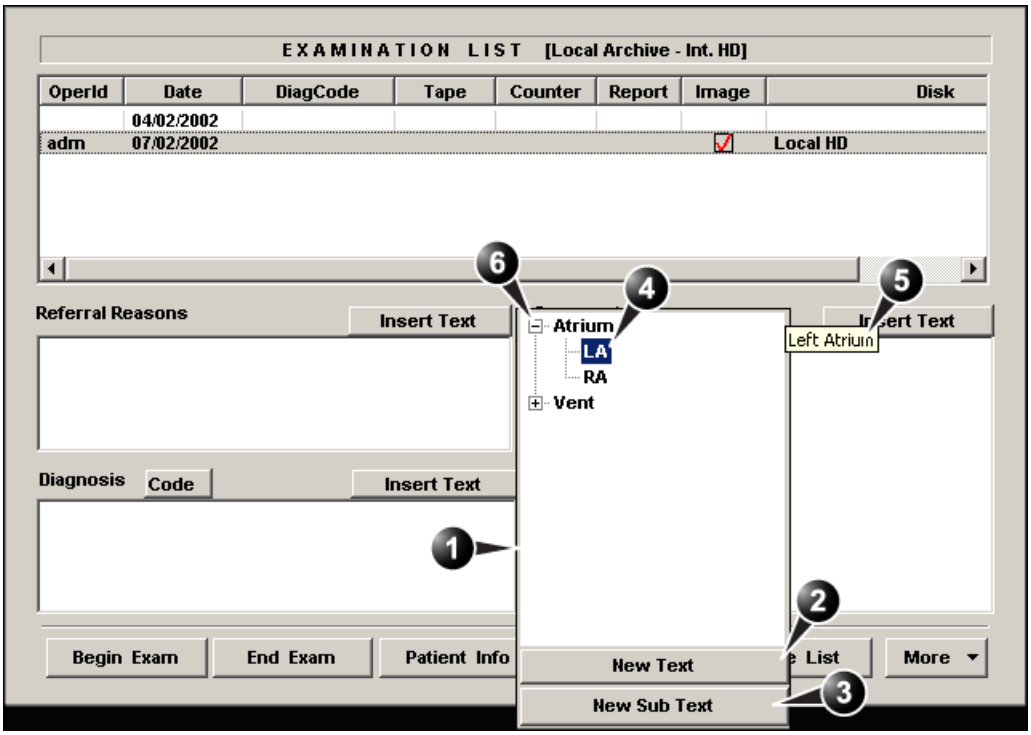
1. In the *Examination list window*, trackball to **Insert Text** over the actual field.
2. Press **SELECT**.
   The *Pre-defined texts list* is displayed showing the abbreviations for the pre-defined text inputs (see Figure 8-10). The list has two levels, expand the list by selecting **[+]** in front of a top level text input.
3. Trackball to the pre-defined text input to insert.
   The entire text is displayed as a preview (see Figure 8-10).
4. Press **SELECT** twice (double mouse click).
   The text is inserted in the corresponding field at the cursor position.

*The **Insert Text** key can be configured to display an extended writing field (see page 440). In this configuration, the pre-defined text input function is started from within this new window.*

Creating text input

1. In the *Examination list window*, trackball to **Insert Text** over the actual field.
2. Press **SELECT**.
   The *Pre-defined texts list* is displayed (see Figure 8-10).
3. Select **New text** in the *Pre-defined texts list* to create a new top level text input
   or
   select a top level text input and select **New subtext** to create a sublevel text input.
   The *Text input window* is displayed.
4. Type an abbreviation in the *Code field*.
5. Type the text input in the *Full text window*.
6. Press **OK** to confirm and exit.

The *Pre-defined texts list* is updated accordingly.



1. **Pre-defined text input list**
2. **Create top level text input**
3. **Create sublevel text input**
4. **Highlighted text input**
5. **Preview of highlighted text input**
6. **Expanded text input**

Figure 8-10: The pre-defined text input tool

Editing Demographic details

WARNING

If you modify the Patient ID, Last name, First name or Date of birth on a patient in the archive, be aware that the contents of the archived images for that patient is not updated. If the images are still in the buffer and not yet archived, the image files are updated if you modify any patient information, but not if the images are archived. So if any of these images are later on exported to DICOM media or DICOM server, they will still contain the original patient information, as it was before you did the modification in the archive. The system does not alter the contents of the image files at all when doing DICOM export.**

1. Press **PATIENT INFO**.
   The *Patient information window* is displayed.
2. Trackball to the field to edit.
3. Press **SELECT** on the control panel.
4. Using the alphanumeric keyboard, edit the information.

CAUTION

Do NOT use '\' or '^' in patient information fields, as these characters might cause problems with some DICOM devices.

Alternative: Press any active scanning mode key.

5. Press the **EXAM LIST** assignable to go back to the *Examination list window.* **OR**
   Press **ARCHIVE** on the control panel to quit the archive.

Deleting archived information

To delete a patient record

Only user logged in with full operator rights can delete patient records (see page 449 for further information).

1. Press **ARCHIVE** on the Front panel.
   The *Search/Create Patient window* is displayed (Figure 8-7, page 280).
2. Type the patient Last Name, and/or ID.
3. Trackball to the actual patient record.
4. Press **SELECT** to highlight the patient record to delete.
5. Press **Delete** in the *Search/Create Patient window*.
   A dialogue box is displayed asking for confirmation of the deletion (Figure 8-11).
6. Trackball to **OK** and press **SELECT** on the control panel.

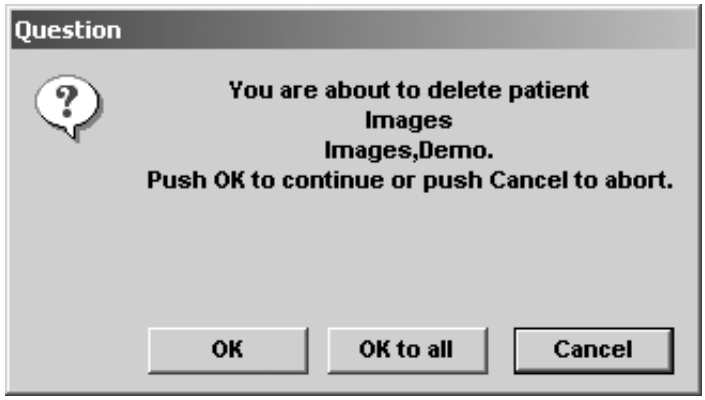


Figure 8-11: Delete patient record confirmation prompt

To delete an examination

1. Press **ARCHIVE** on the Front panel.
   The *Search/Create Patient window* is displayed (Figure 8-7, page 280).
2. Type the patient Last Name, and/or ID depending on system configuration.
3. Trackball to the actual patient record and double-click the Trackball **SELECT** key (or press **SELECT** once and **SELECT PATIENT**) to select the patient.
   The *Examination list window* is displayed.
4. Trackball to the examination to delete.

5. Press the trackball **SELECT** key.
6. Press **More** in the *Examination list window* (see Figure 8-9, page 284).
7. Press **Del Exam** to delete the examination.
   A warning message is displayed asking the user to confirm the action to perform (see Figure 8-12).
8. Trackball to **OK** and press **SELECT** to delete the selected examination.
   Trackball to **Cancel** and press **SELECT** to abort deletion.

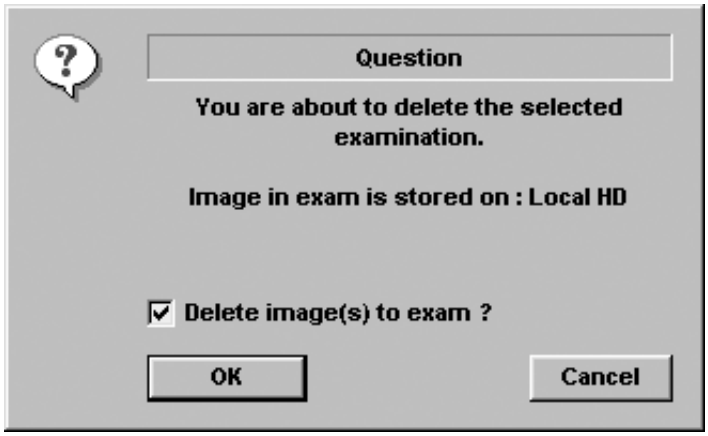

Question
You are about to delete the selected examination.
Image in exam is stored on : Local HD
Delete image(s) to exam ?
OK
Cancel

Figure 8-12: Delete Examination prompt

To delete an image

1. Press **ARCHIVE** on the Front panel.
   The *Search/Create Patient window* is displayed.
2. Type the patient Last Name, and/or ID.
3. Trackball to the required patient to highlight the record.
4. Press the **SELECT** assignable.
   The *Examination list window* is displayed.
5. Trackball to the actual examination in the *Examination list window*.
6. Press the **SELECT** assignable.
7. Press the **REVIEW** assignable.
   The images for the selected examination are displayed on the *Review screen* (Figure 8-15, page 294).

Repeat steps 8 and 9 to delete several images.

8. Trackball to the image to delete.
9. Press **SELECT** on the control panel.
10. Press **Delete**.
    A pop-up dialog box is displayed asking for confirmation of the deletion.
11. Trackball to **OK** and press **SELECT** on the control panel.
    The image is deleted.

Moving examinations

An examination can be moved from one patient record to another. This feature should only be used if an examination was performed and stored to a wrong patient record.

△
CAUTION

When moving an examination, verify that the target patient record is correct.

1. In the *Search/Create Patient window* press **[+]** in front of the patient record containing the examination(s) to move (see Figure 8-7, page 280).
2. Select the examination to move.
3. Press **More** in the lower, right-hand corner of the *Search/Create Patient window*.
4. Press **Move Exam**.
   The *Move exam window* is displayed.

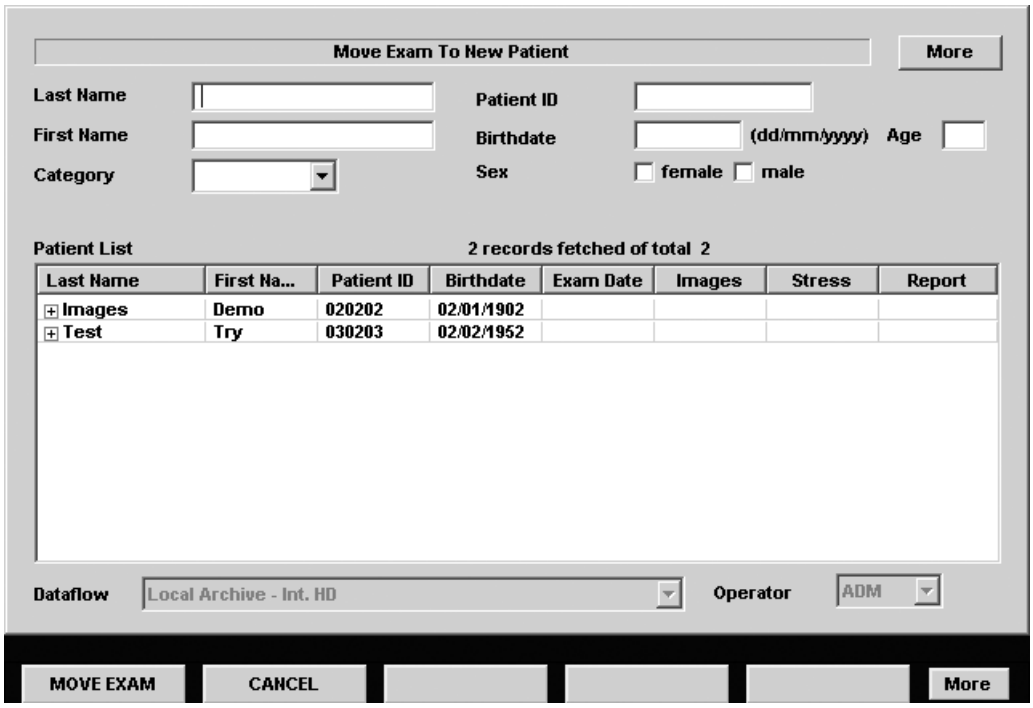


Figure 8-13: The Move exam window

5. Search and select the target patient record.
6. Press **Move Exam**.
   A warning message is displayed asking the user to confirm the action to perform (see Figure 8-14).

△
CAUTION

Make sure that the patient record selected is correct.

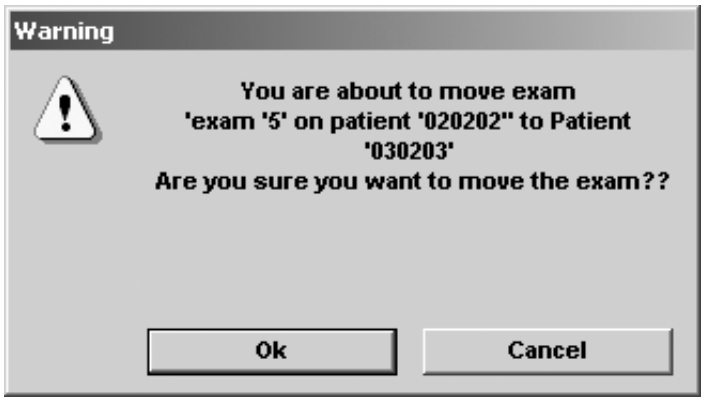


Figure 8-14: Moving examination prompt

7. Trackball to **OK** and press **SELECT**.
   An information window is displayed to confirm the operation.
8. Press **OK**.

Review images in archive

There are two ways to access to archived images:

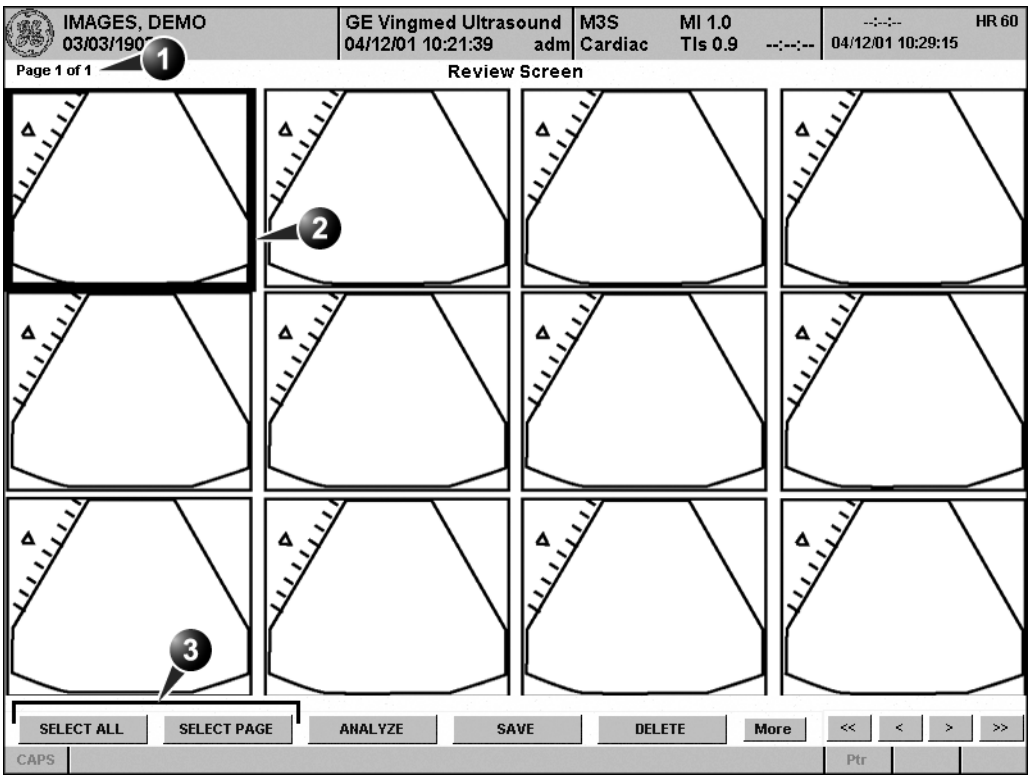
- Review the images from a selected examination.
- Select images from the *Image list screen* displaying all the images sorted by examination sessions for the actual patient.

Review the images from a selected examination

1. In the *Examination list window* (see Figure 8-9, page 284), trackball to the actual examination.
2. Press **SELECT** on the control panel to highlight the examination.
3. Press **REVIEW** on the control panel.
   The stored images for the selected examination are displayed in the *Review screen* (see Figure 8-15).

To analyze images:

1. Press **SELECT** on the images to analyze.
2. Press **ANALYZE**.



1. **Page number**
2. **Selected image (bold frame)**
3. **Selection tools**

Figure 8-15: The Review screen

Select images from the Image list screen

The procedure described below enables the analysis of images belonging to different examinations for a selected patient record. If images are stored on multiple removable media, they have to be restored to the local hard drive prior to review as described below.

1. In the *Examination list window* (see Figure 8-9, page 284),

press **Image list**.
The *Image list screen* is displayed (see Figure 8-18) showing thumbnails of stored images for the actual patient sorted by examination.
If the images are stored on a removable media that is not mounted, the image thumbnail is replaced by a symbol.

2. Press **SELECT** on the images to review or press **ANALYSE** to review all images.
   - If all images are available the images are displayed for review.
   - If some of the images are not available locally the *Restore images window* is displayed.

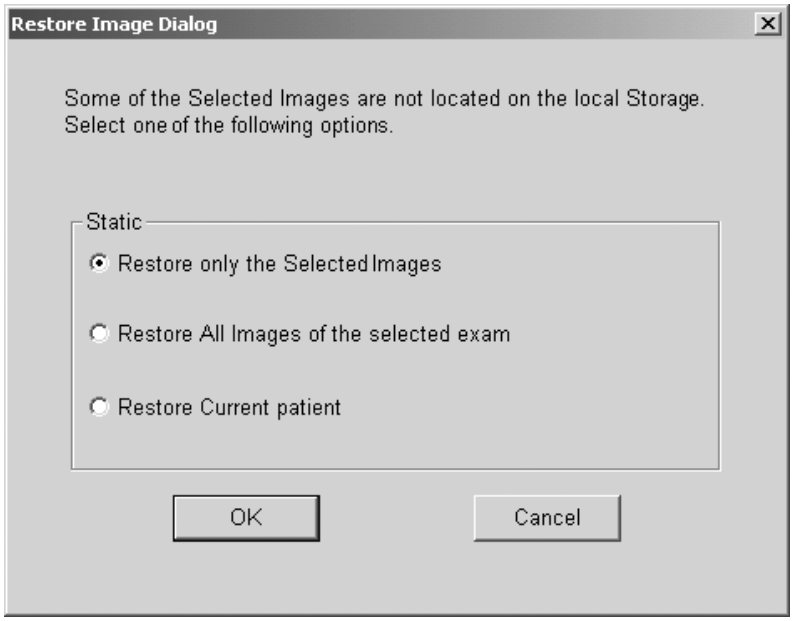

Restore Image Dialog
Some of the Selected Images are not located on the local Storage.
Select one of the following options.
Static
Restore only the Selected Images
Restore All Images of the selected exam
Restore Current patient
OK
Cancel

Figure 8-16: The Restore images window

3. Select between:
   - **Restore only the selected images**: only selected images that are not available locally are restored.
   - **Restore all images of the selected exam**: all images that are not available locally in the exams where an image was selected are restored.
   - **Restore current patient**: restores all images in all

examinations.

4. Press **OK**.
   The *Insert media window* is displayed.

Dialog
Insert the Storage Media Labelled - TEST
Press OK to Continue, Cancel to abort.
If the require media is not available press Skip Media.
OK
Skip Media
Cancel

Figure 8-17: The Insert media window

5. Insert the required media.
6. Select between:
   - **OK**: the images on the mounted media are restored on the local hard drive. If not all the required images are on the inserted media, the user is prompted to insert another media until all required images are restored on the hard drive.
   - **Skip media**: the images stored on the media required are not restored. If not all the required images are on the inserted media, the user is prompted to insert another media until all required images are restored on the hard drive.
   - **Cancel**: no images are restored.

   The selected images are displayed for review.

1. **Examination**
2. **Examination date and archive location**
3. **Selected image**
4. **Preview of selected image**
5. **Missing images**

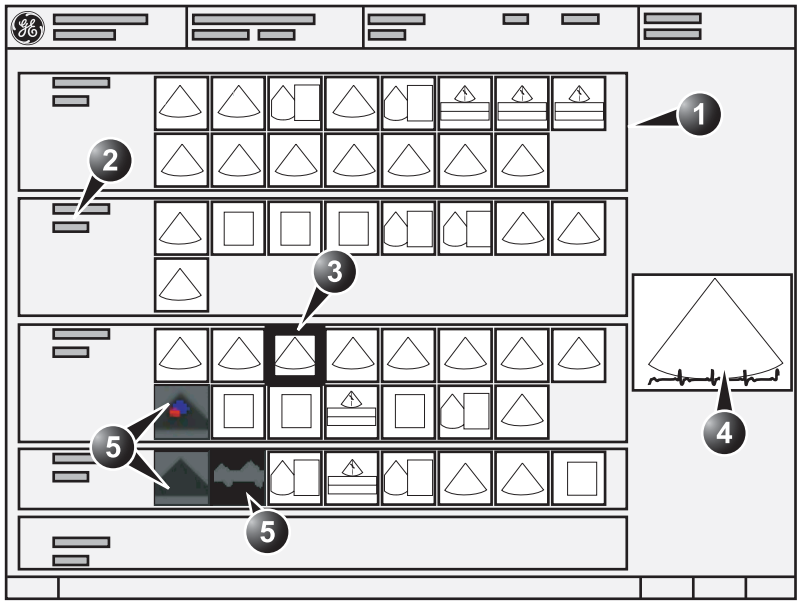


Figure 8-18: The Image list screen

Connectivity

This section describes the communication and connection options for the Vivid 7/Vivid 7 PRO ultrasound unit with other devices in the hospital information system. This section covers the procedures for optimal data management from a Vivid 7/ Vivid 7 PRO in the following scenarios:

- A stand-alone Vivid 7/Vivid 7 PRO (page 301).
- A Vivid 7/Vivid 7 PRO and one or several EchoPAC PC workstations in a sneaker net environment (page 303).
- A Vivid 7/Vivid 7 PRO and an EchoPAC PC workstations in a direct connect environment (page 307).
- A Vivid 7/Vivid 7 PRO and a DICOM server in a network (page 310).

The dataflow concept

Communication between the Vivid 7/Vivid 7 PRO ultrasound unit and other information providers on the network takes the form of dataflows. Each dataflow defines the transfer of patient information from an input source to the unit, and from the unit to an output source (see examples on Figure 8-19). Patient information can include demographic data and images, as well as reports and Measurement and Analysis data. A dataflow is a set of pre-configured services. Selecting a dataflow will automatically customize the ultrasound unit to work according to the services associated with this dataflow. By utilizing dataflows, the user can configure the Vivid 7/Vivid 7 PRO ultrasound unit to optimally meet the needs of the facility, while keeping the user interface unchanged. Once the dataflow is selected, the actual location of the database is entirely transparent.

A: **LocalArchive-Int.HD dataflow:**

The local database is used for patient archiving. Images are stored to internal harddrive.

B: **LocalArchive-MOD dataflow:**

The local database is used for patient archiving. Images are stored to a MOD

C: **RemoteArch-RemoteHD dataflow**:

A remote database (here EchoPAC PC) is used for patient archiving. Images are stored to a remote archive (here EchoPAC PC).

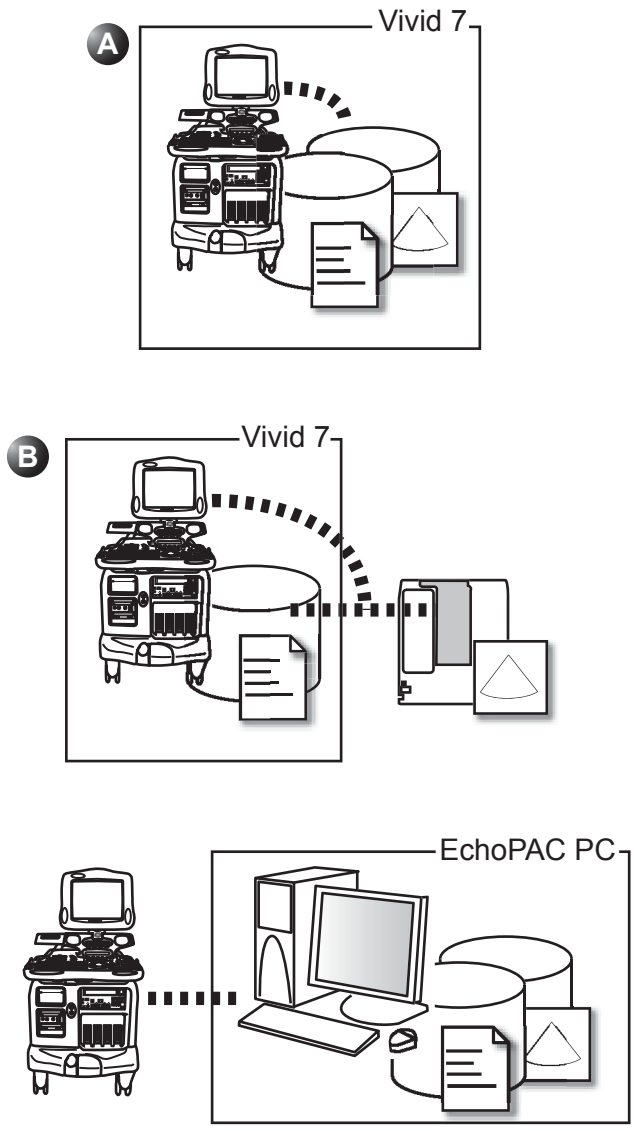


Figure 8-19: Examples of dataflows

A default dataflow can be selected from the sublevel Dataflow in the subgroup Connectivity of the configuration management package (see page 423and following pages).

The dataflow is otherwise selected from the *Search/Create Patient window* (’Creating a new Patient record or starting an examination from an existing patient record’ on page 49).

Refer to Chapter 12, ’Presets and System setup’ on page 391 for a complete list and description of supported dataflows.

Stand-alone scanner

In this scenario images will most likely be reviewed from VCR tape. If digital images are stored, they should be saved directly on a MOD.

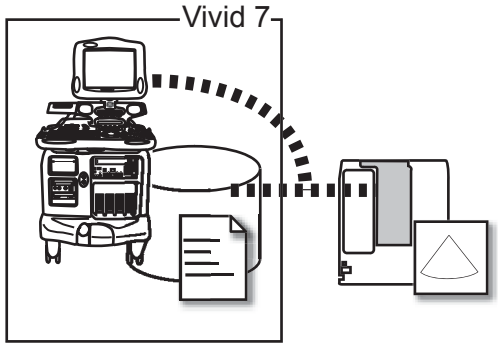


Figure 8-20: Stan-alone scanner with LocalArchive-MOD dataflow

Dataflow configuration

1. Select the **LocalArchive-MOD** dataflow as default dataflow in the sublevel *Dataflow* in the subgroup *Connectivity* of the Configuration management package (see page 424 and following pages).
   In this configuration the local database is used for patient archiving. Images are stored to a MOD. The stored image files consist of raw data only, together with a single-frame DICOM preview image (no DICOM multi-frame is stored).

△
CAUTION

Keep a manual log of disk labels.

A formatted MOD (see page 435) must be inserted when logging on the system when using this dataflow.

Image review

The same dataflow is used for review on the system.

Backup

Patient and report archives, presets and templates

1. Perform a backup on a weekly basis as described in

’Backup procedure’ on page 329.

Images

There is no backup function for the images in this scenario (no creation of a safety copy). The image MOD is the recommended media for long-term storage of images.

A scanner and EchoPAC PC in a sneaker net environment

In this scenario the EchoPAC PC (one or several) is used for review of studies acquired on one or more Vivid 7/Vivid 7 PRO without being connected in a network.

Images can be stored on the scanner's internal harddrive (recommended) or on a dedicated MOD.

Images stored on the internal harddrive

Vivid 7: dataflow LocalArchive-IntHD

EXP: export from LocalArchive-Int.HD to Removable MOD Archive

IMP: import from Removable MOD Archive to LocalArchive-Int.HD

EchoPAC PC: dataflow LocalArchive-Int.HD

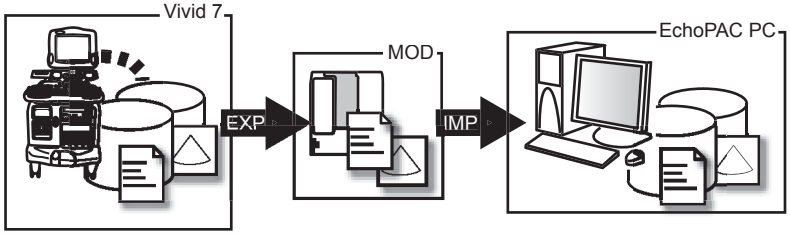


Figure 8-21: A scanner and EchoPAC PC in a sneaker net with images stored on the scanner's harddrive

In this configuration images are first stored on the scanner's harddrive and then exported from the scanner's harddrive to a sneaker MOD and finally imported from the sneaker MOD to the EchoPAC PC's internal harddrive.

Scanner's dataflow configuration

1. Select the **LocalArchive-Int.HD** dataflow as default dataflow in the sublevel *Dataflow* in the subgroup *Connectivity* of the Configuration management package (see page 424 and following pages).
   The local database is used for patient archiving. Images are stored to internal harddrive.

Export from Vivid 7/Vivid 7 PRO and import on EchoPAC PC

1. Export the data (images, demographics, measurements and report) for the patient(s) to be reviewed on a blank dedicated formatted MOD as describes in 'Export/Import

patient records/examinations' on page 315.
Export from **LocalArchive-Int.HD** to **Removable MOD Archive**.
To free space in the internal harddrive on the scanner, check the command **Delete selected patients after copy** in the *Export patient window* (see Figure 8-28, page 317).
Make sure that the option **Copy images** is checked.

2. Import the data from the Export/import MOD to EchoPAC PC internal harddrive using the Import function as described in the workstation user manual.
Import from **Removable MOD Archive** to **LocalArchive-Int.HD**
Make sure that the option **Copy images** is checked.

Review on the EchoPAC PC workstation

1. Select the **LocalArchive-Int.HD** dataflow on the EchoPAC PC (can be configured as default dataflow).
2. Press **Archive** and select the patient to be reviewed.

Backup of images on the EchoPAC PC workstation

1. To avoid filling up the internal harddrive on the EchoPAC PC workstation move the images from the EchoPAC PC harddrive to a dedicated MOD on a weekly basis using the Move images function as described in 'Data Backup and restore' on page 328.

△
CAUTION

Keep a manual log of disk labels.

Images stored on dedicated MO disk

Vivid 7: dataflow LocalArchive-MOD (MOD 1)

EXP: export patient data from LocalArchive-Int.HD to Removable MOD Archive (MOD 2)

IMP: import patient data (not images) from Removable MOD Archive (MOD 2) to LocalArchive-Int.HD

EchoPAC PC: dataflow LocalArchive-MOD

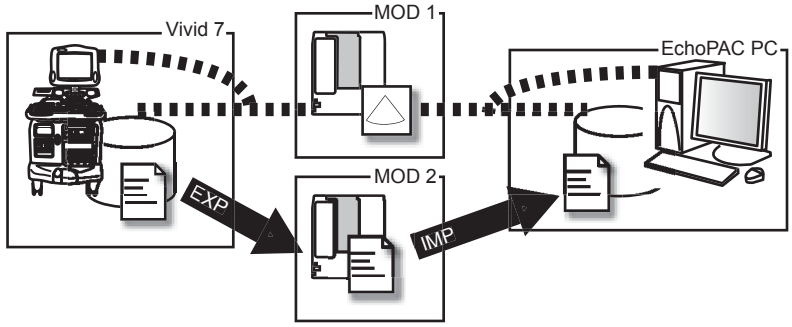


Figure 8-22: A scanner and EchoPAC PC in a sneaker net with images stored on a removable MOD

In this configuration the images are stored directly on a dedicated MOD and imported to the EchoPAC PC's internal harddrive.

Scanner's dataflow configuration

1. Select **LocalArchive-MOD** dataflow in the sublevel *Dataflow* in the subgroup *Connectivity* of the Configuration management packages default dataflow (see page 424 and following pages).
   In this configuration the local database is used for patient archiving. Images are stored to a MOD.

Keep a manual log of disk labels.

△
CAUTION

A formatted MOD (see page 435) must be inserted when logging on the system using this dataflow.

Export from Vivid 7/Vivid 7 PRO and import on EchoPAC PC

1. Export the data (demographics, measurements and report) for the patient(s) to be reviewed on a blank dedicated formatted MOD as describes in 'Export/Import patient records/examinations' on page 315.
   Export from **LocalArchive-Int.HD** to **Removable MOD Archive**.

Make sure that the option **Copy images** is unchecked.

△
CAUTION

Use a NEW blank formatted MOD for this purpose. Do NOT use the MOD used for image storage.

2. Import the demographics, measurements and report data from the Export/import MOD to EchoPAC PC internal harddrive using the Import function as described in the workstation user manual.
   Import from **Removable MOD Archive** to **LocalArchive-Int.HD**.

Review on the EchoPAC PC workstation

1. After completion of the previous step, insert the Image MOD in the EchoPAC PC MO drive.
2. Select the **LocalArchive-MOD** dataflow on the EchoPAC PC (can be configured as default dataflow).
3. Press **Archive** and select the patient to be reviewed.

Backup on the EchoPAC PC workstation

Patient and report archives, presets and templates

1. Perform a backup on a weekly basis on a dedicated MOD using the Backup function as described in the workstation user manual.

△
CAUTION

Keep a manual log of disk labels.

Images

There is no backup function for the images in this scenario (no creation of a safety copy). The image MOD is the recommended media for long-term storage of images.

A scanner and EchoPAC PC in a direct connect environment

In this scenario the data is transferred from the Vivid 7/ Vivid 7 PRO to a dedicated EchoPAC PC workstation over the Ethernet (either in a peer-to-peer connection or with a crossover cable, or in a network). The database from the EchoPAC PC is used as the master and images are stored directly to the EchoPAC PC internal harddrive. In this configuration the scanner is just an intermediate acquisition unit which after completion of a study, will not contain any patient information, measurements or images.

Vivid 7: dataflow RemoteArch-RemoteHD

EchoPAC PC: dataflow LocalArchive-Int.HD

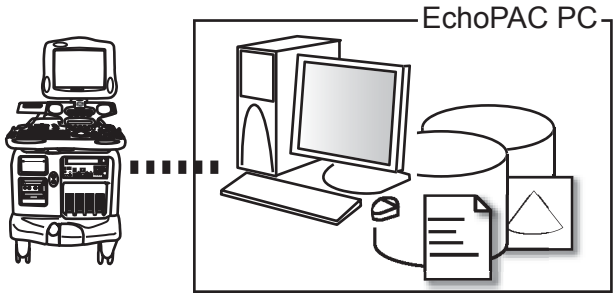


Figure 8-23: A scanner and EchoPAC PC in a direct connect environment (pier to pier or network)

The acquisition can be done online or offline. Both situations are described below.

Direct connect with online acquisition

Scanner's dataflow configuration

1. Select the **RemoteArch-RemoteHD** dataflow as default dataflow in the sublevel *Dataflow* in the subgroup *Connectivity* of the Configuration management package (see page 424 and following pages).
   When saving the study on the scanner, the images are transferred from the scanner's image buffer to the harddrive of the EchoPAC PC. Patient demographics, measurements and reports are transferred on the fly when entering the information on the Vivid 7/Vivid 7 PRO.

Review on the EchoPAC PC workstation

1. Select the **LocalArchive-Int.HD** dataflow on the EchoPAC PC (can be configured as default dataflow).

△
CAUTION

Do NOT open a study on the EchoPAC PC workstation before the study is closed on the scanner.

2. Press **Archive** and select the patient to be reviewed.

Backup

Patient and report archives, presets and templates

1. Perform a backup on a weekly basis on a dedicated MOD using the Backup function as described in the workstation user manual.

△
CAUTION

Keep a manual log of disk labels.

Images

1. Move images on a weekly basis from the internal harddrive of the EchoPAC PC to a dedicated MOD as described in 'Backup procedure' on page 329.

△
CAUTION

Keep a manual log of disk labels.

Direct connect with offline acquisition

If going offline the archive from the EchoPAC PC must be exported to the scanner prior disconnection as follow.

Copy of the EchoPAC PC archive prior offline acquisition

1. Make sure there are no studies on the internal harddrive of the scanner (dataflow **LocalArchive-Int.HD**) that have not been copied to the EchoPAC PC. If so use the Export/ import procedure (see page 315) to copy them prior to proceeding.
   While connected, export from **LocalArchive-Int.HD** (scanner) to **Remote Archive-Remote Storage**.
   Make sure that the option **Copy images** is checked.

2. Export the data (demographics, measurements and report) from EchoPAC PC to the scanner.
   Export from EchoPAC PC **LocalArchive-Int.HD** to **RemoteArch-RemoteHD**.

△
CAUTION

Restore ONLY the patient and report archives, NOT the system and user defined configurations.

Scanner's dataflow configuration for offline acquisition

1. When offline, select the **LocalArchive-IntHD** dataflow. The local database is used for patient archiving. Images are stored to internal harddrive.

Export examinations done offline from the scanner to EchoPAC PC

1. When reconnected, export the data (images, demographics, measurements and report) for the examination(s) done offline to EchoPAC PC as describes in 'Export/Import patient records/examinations' on page 315.

   *Press **Today** to display today's exams to ease the search.*

   Export from **LocalArchive-Int.HD** to **RemoteArch-RemoteHD**.
   Make sure that the option **Copy images** is checked.
   To free space in the internal harddrive on the scanner, check the command **Delete selected patient(s) after copy** in the *Export patient window* (see Figure 8-28, page 317).

The examination done offline can now be reviewed on the workstation.

A scanner and a DICOM server in a network

In this scenario the Vivid 7/Vivid 7 PRO is configured to work with a DICOM server in a network environment. Images are first saved on the local image buffer on the scanner. At the end of the examination the images are sent to the DICOM server via a DICOM spooler.

This scenario requires that the scanner is configured to be connected to the DICOM server as described below.

Scanner configuration

To work against the DICOM server the following information has to be entered in the scanner:

- The DICOM server IP address, subnet mask and eventually the gateway
- The DICOM server port number
- The DICOM server AE title (the server's name)
- The scanner IP address

In addition the AE Title of the scanner may have to be entered in the DICOM server setup.

TCPIP setting on the scanner

1. Enter the DICOM server IP address, subnet mask and eventually the default gateway in the *TCPIP sublevel window* (IP settings field) in the configuration management package of the Vivid 7/Vivid 7 PRO ultrasound unit (see 'TCP/IP' on page 442).

△
CAUTION

Do NOT change the Remote archive setup in TCPIP sublevel.

Setup of the DICOM server in the scanner's configuration management package

1. In the scanner's configuration package select the sublevel

Dataflow in the subgroup *Connectivity*.

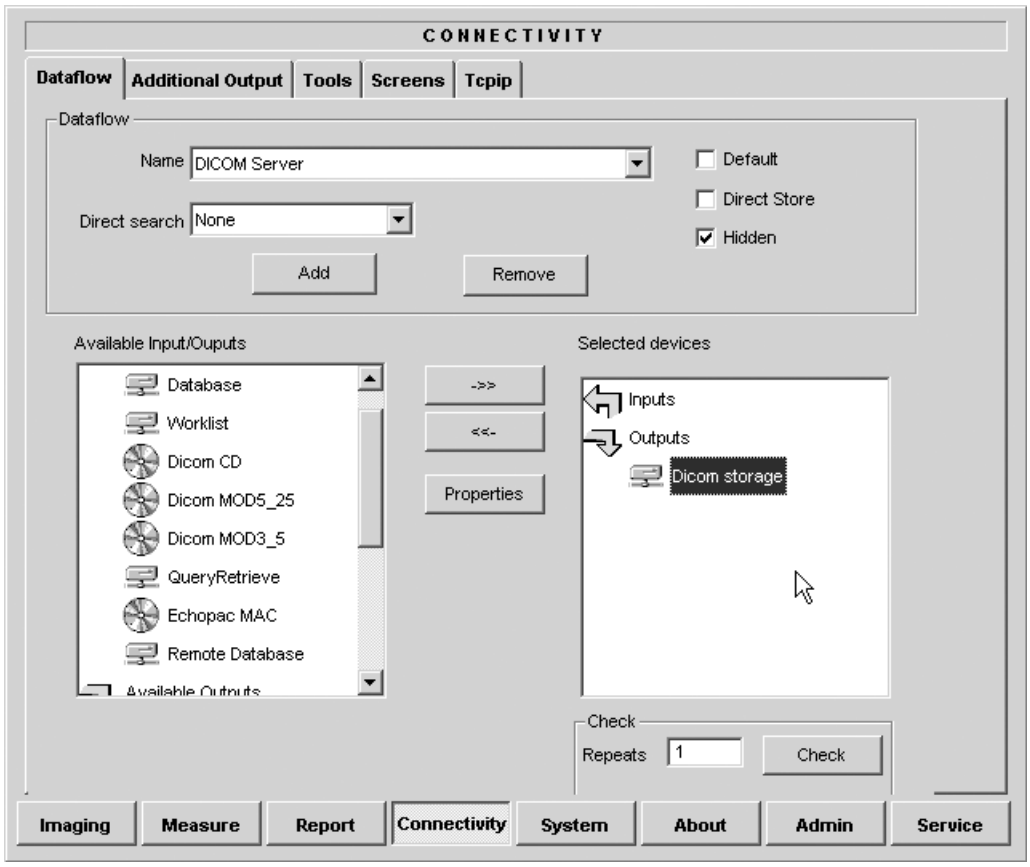


Figure 8-24: The DICOM server setup on the scanner

2. Select **DICOM Server** in the *Name pull-down menu*.
3. Select the Output device **DICOM storage** in the *Selected devices field* and press **Properties**.
   The Properties window for the selected device is displayed.

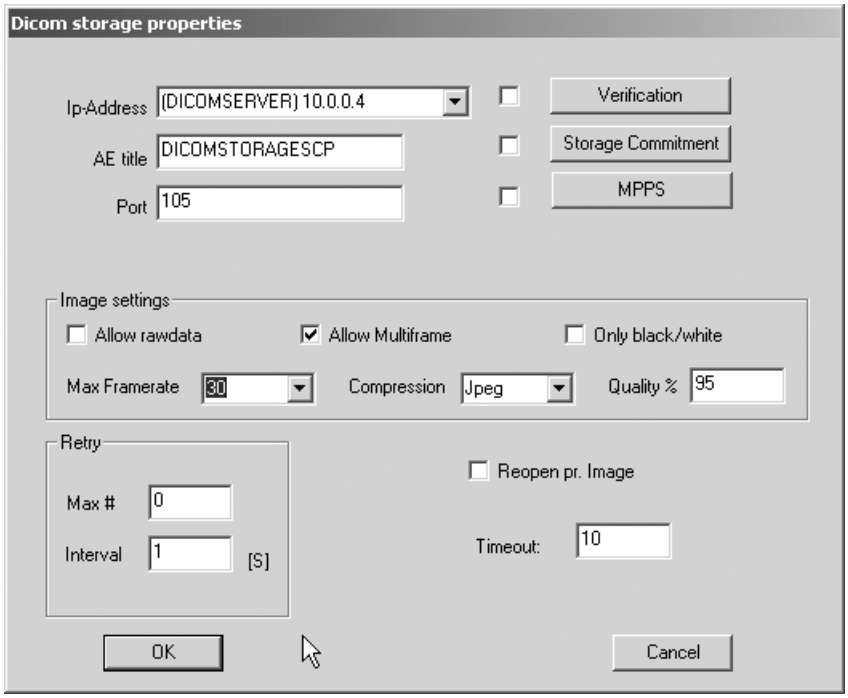


Figure 8-25: The DICOM storage properties window

4. Select the DICOM server IP address.
5. Enter the following information:
   - Enter the DICOM server **name**.
   - Enter the DICOM server **AE title**. This entry is case sensitive and must match exactly.
   - Enter the DICOM server **port**.
   - Keep **Reopen per image** unchecked.
   - Keep **Allow raw data** unchecked.
   - Set **Max Frame rate** to 30.
   - Keep **Only Black and White** unchecked.
   - Set **Compression** to JPEG.
   - Set **Quality** to 95.
   - Check **Allow multiframe**.
6. Press **CONFIG** (**F2**) to exit.

Checking the connection to the DICOM server

1. Press **CONFIG** (**F2**) on the Control panel and log on as administrator.
2. Select the subgroup *Connectivity*.
3. In the sublevel *Dataflow* select **DICOM Server**.
4. Select the Output device **DICOM storage** in the *Selected devices field*
5. Press **Check**.
   - A green check mark is displayed if the connection to the DICOM server is successful.
   - A red cross is displayed if the connection to the DICOM server failed. In that case double check cabling, TCPIP addresses and subnet mask settings.

Scanner's dataflow configuration

1. Select the **DICOM server** dataflow as default dataflow in the sublevel *Dataflow* in the subgroup *Connectivity* of the Configuration management package (see page 424 and following pages).
2. Press **CONFIG** (**F2**) to exit. Press **OK** in all messages appearing under exit.
3. Reboot the scanner.

Performing a study

Online scanner

1. Create a new patient and perform the examination in a usual manner.
   During the examination images are temporarily stored in the local buffer on the system.
2. At the end of the study press **END EXAM** on the Control panel.
   The save images dialogue window is displayed.

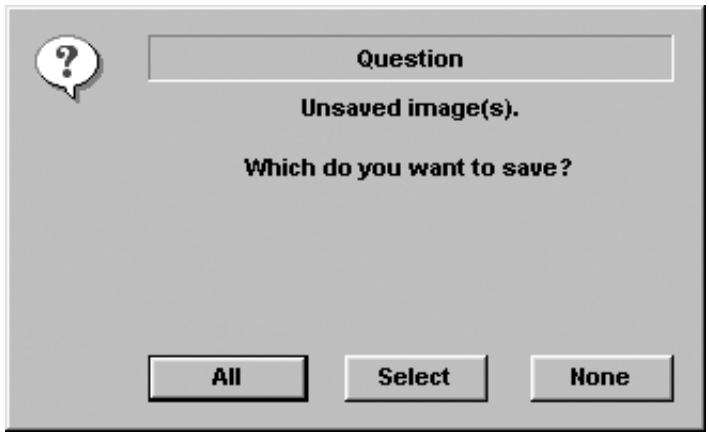


Figure 8-26: The Save images dialogue window

3. Press **All** to save all images on the DICOM server or press **Select** to display the *Image review screen* where to select specific images to be saved.
   The images are transferred to the server via the DICOM spooler.
4. Press F4 or ALT+S to display the DICOM spooler (see 'DICOM spooler' on page 325 for further details).

Offline scanner

When working offline the images are stored in the DICOM spooler. Images can be sent to the DICOM server when re-connecting the system to the network.

To save images acquired offline on the DICOM server:

1. With the scanner connected, press F4 or ALT+S to display the DICOM spooler.
2. Select a study in the *DICOM spooler window*.
3. Press **Resend**.
   The images of the selected study are transferred to the DICOM server.
4. Repeat the procedure for each study.

Export/Import patient records/examinations

Patient records/examinations from the local archive on one system (Vivid 7 or EchoPAC PC) can be exported to the local archive on another system via a formatted Magneto Optical (MO) disk or CD-R. Patient records/examinations from the local archive can also be exported directly to a remote archive (Echo server, DICOM server or EchoPAC PC depending on the environment). In addition patient records/examinations from a remote archive (Echo server or EchoPAC PC depending on the environment) can be exported to a removable media or to a DICOM server. Database information (patient and report archives) can be exported with or without images. No data is deleted from the source archive when exporting data unless the command **Delete selected patient(s) after copy** is checked in the Export patient window (see Figure 8-28, page 317).

Similarly, patient records/examinations from the local archive on one system can be imported to the local archive on another system via a formatted MO disk or CD-R. Database information can be imported with or without images. No data is deleted from the source archive when importing data. In addition patient records from a removable archive can be imported to a remote archive (Echo server).

Exporting patient records/examinations

1. Insert a blank formatted (see page 435) removable media in the drive.
2. Press **ARCHIVE** on the Front panel.
   The *Search/Create Patient window* is displayed (Figure 8-7, page 280).
3. Select the source archive in the *Dataflow field*:
   - **LocalArchive-Int.HD**: exports data from the local archive.
   - **RemoteArch-RemoteHD**: exports data from an Echo server.
4. Press **Export** in the *Search/Create Patient window*.
   The *Export dialogue window* is displayed.

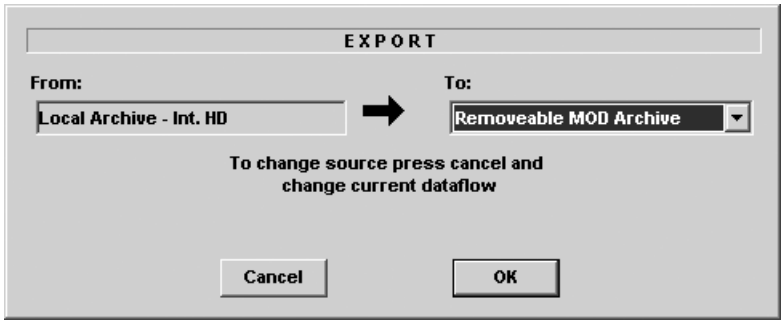


Figure 8-27: The Export Dialogue window

5. Select one of the following destinations from the *Destination drop-down menu*:
   - **Removable MOD Archive**: exports raw and DICOM (if present) data to a removable MOD.
   - **Pure DICOM MOD525**: export DICOM data only to a removable MOD.
   - **Removable CD Archive**: exports raw and DICOM (if present) data to a CD-R.
   - **Pure DICOM CD-R**: export DICOM data only to a CD-R.
   - **Remote Import/Export Archive**: exports raw and DICOM (if present) data to an Echo server (network) or EchoPAC PC (direct connect or network).
   - **Pure DICOM Storage**: exports DICOM data only to a DICOM server.
   - **Excel file**: exports data to a spreadsheet. The excel file is stored in the location defined in the *Sublevel Tools* in the Configuration package (see page 435).
   - **HL7**: exports examination results to the “Vivid HL7 Gateway”, which “feeds” the results to HIS through HL7 protocol. M&A and diagnosis-codes are stored as an Excel file, reports are stored as CHM-files.

     The file path to the shared volume on “Vivid HL7 Gateway” must be pre-configured in the *Sublevel Tools* in the Configuration package (see page 435).
   - **DICOM Print**: prints images to a DICOM printer via DICOM spooler.

- **MPEGvue**: converts ultrasound images to MPEG format readable from a regular computer and export them to a CD.

6. Press **OK**.
   The *Export patient window* is displayed (see Figure 8-28).

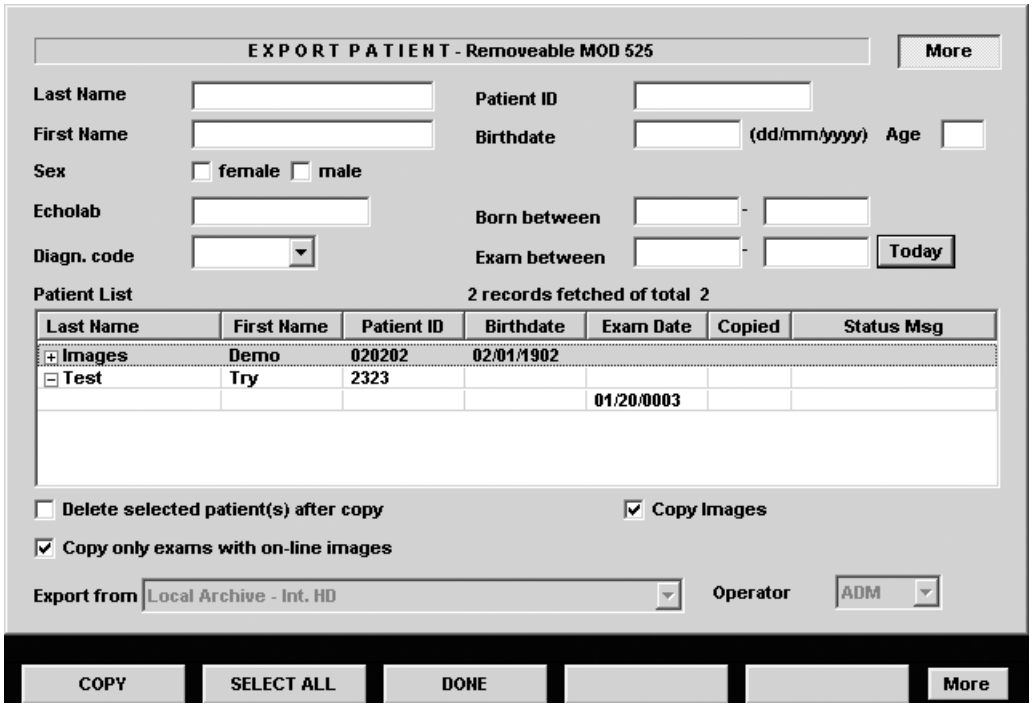


Figure 8-28: The Export patient window

7. Search and Select the patient records/examinations to export in the *Patient list*.
   The following selection methods can be used:
   - Press and hold down **SHIFT** while selecting patient records/examinations to select several consecutive items at a time.
   - Press and hold down **CTRL** while selecting patient records/examinations to select several discrete items.
   - Press **Select all** in the *Export patient window* to export all patient records.

*Press **More** to display the extended **Export patient window** if necessary.*

- Press **Today** to display today's examinations and select the actual examinations.
- Fill in the *Exam between field* to display the patient records done during a specific time period and select the actual records.
- Fill in the *Born between field* to display the patient records of patients born during a specific time period and select the actual records.

8. Adjust the following settings as desired:
   - **Delete selected patient(s) after copy**
   - **Copy images**
   - **Copy only exams with on-line images**: when checked only selected examinations with accessible images will be copied.
9. Press **Copy**.
   If one or more patient examination is already present in the destination archive the *Export/Import conflict window* is displayed (see Figure 8-29). For each conflicting item, select:
   Keep: to keep the existing examination in the destination archive.
   Replace: to replace the existing examination with the corresponding item in the source archive.

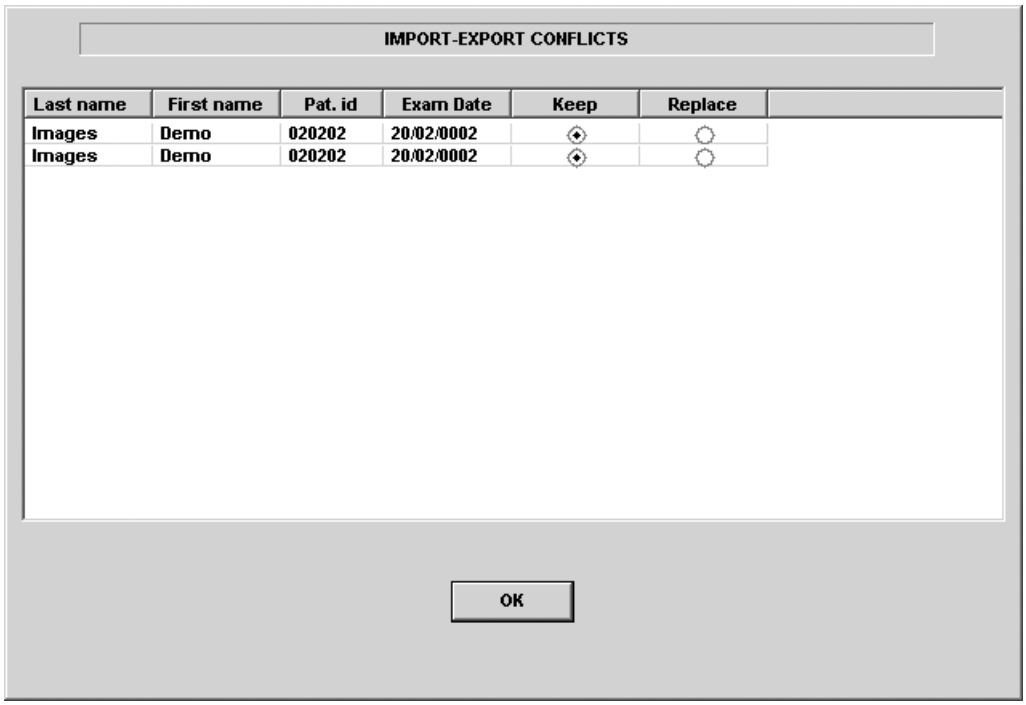


Figure 8-29: The Export/Import conflict window

Press **OK** to resume export.
A progress indicator is displayed. When done a status window is displayed showing the number of patient records that have been successfully exported.

10. Press **OK**.
    A check mark is displayed in the *Copied field* in the *Export patient window* for each item exported.
    A status message is displayed for each item exported. Make sure that the operation was successful for each item exported.
11. Press **Done** in the *Export patient window* to complete the process.

Do not eject the CD using the button on the CD drive

12. Press **ALT**+**E** to eject the disk.
    The *Eject device menu* is displayed.

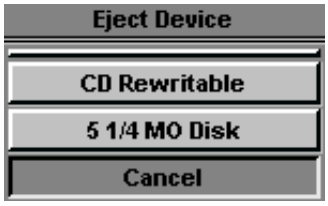


Figure 8-30: The Eject device menu

13. Select the relevant media.
    The selected removable media is ejected.

Importing patient records/examinations

1. Insert the removable media of the source archive in the corresponding drive (MO drive or CD-ROM).
2. Press **ARCHIVE** on the Front panel.
   The *Search/Create Patient window* is displayed (Figure 8-7, page 280).
3. Select destination archive in the *Dataflow field*:
   - **LocalArchive-Int.HD**: imports data to the local archive.
   - **RemoteArch-RemoteHD**: imports data to an Echo server (network) or an EchoPAC PC (direct connect).
4. Press **Import** in the *Search/Create Patient window*.
   The *Import dialogue window* is displayed (see Figure 8-31).

Figure 8-31: The Import Dialogue window

5. Select one of the following source archive from the *Source drop-down menu*:
   - **Removable MOD Archive**: imports raw and DICOM data (if present) from a MOD.
   - **Pure DICOM MOD525**: imports DICOM data only from a MOD.
   - **Removable CD Archive**: imports raw and DICOM data (if present) from a CD-R.
   - **Pure DICOM CD-R**: imports DICOM data only from a CD-R.
   - **Remote Import/Export Archive**: imports raw and DICOM (if present) data from an Echo server (network)

or EchoPAC PC (direct connect or network).

- **Query Retrieve**: imports data from a DICOM server.

6. Press **OK**.
   The *Import patient window* is displayed (see Figure 8-32).

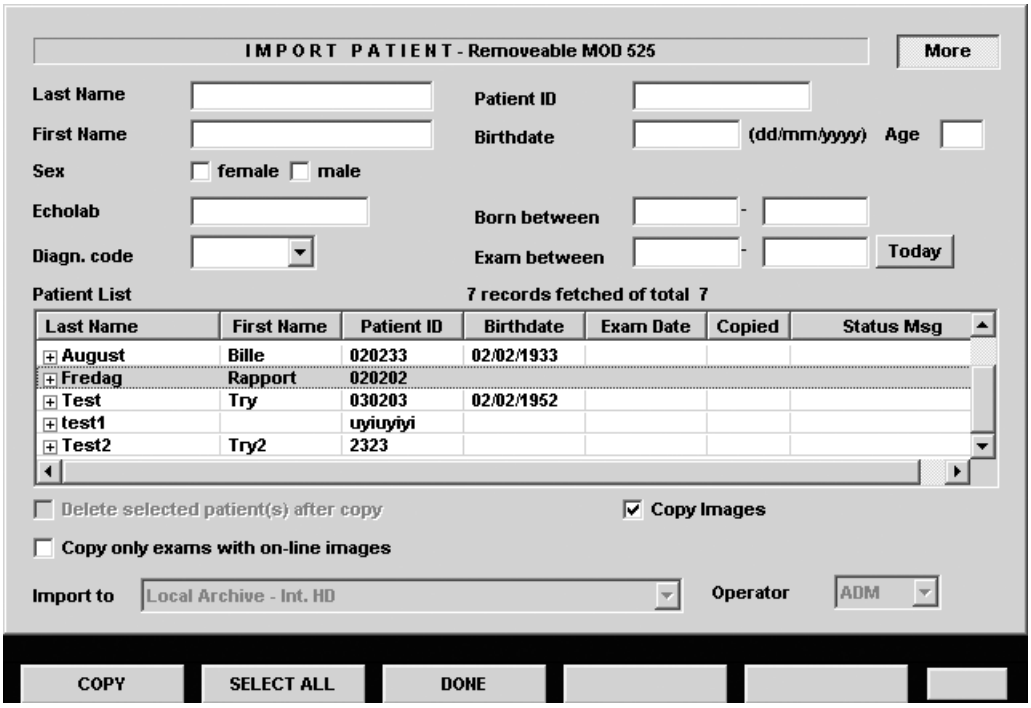


Figure 8-32: The Import patient window

7. Search and select the patient records to import in the *Patient list*.
   The following selection methods can be used:
   - Press and hold down **SHIFT** while selecting patient records/examinations to select several consecutive items at a time.
   - Press and hold down **CTRL** while selecting patient records/examinations to select several discrete items.
   - Press **Select all** in the *Import patient window* to export all patient records.

*Press **More** to display the extended **Import patient window** if necessary.*

- Press **Today** to display today's examinations and select the actual examinations.
- Fill out the *Exam between field* to display the patient records done during a specific time period and select the actual records.
- Fill out the *Born between field* to display the patient records of patients born during a specific time period and select the actual records.

8. Adjust the following settings as desired:
   - **Copy images**
   - **Copy only exams with on-line images**: when checked only selected examinations with accessible images will be copied.
9. Press **Copy**.
   If one or more patient examination is already present in the destination archive the *Export/Import conflict window* is displayed (see Figure 8-29). For each conflicting item, select:
   Keep: to keep the existing examination in the destination archive.
   Replace: to replace the existing examination with the corresponding item in the source archive.

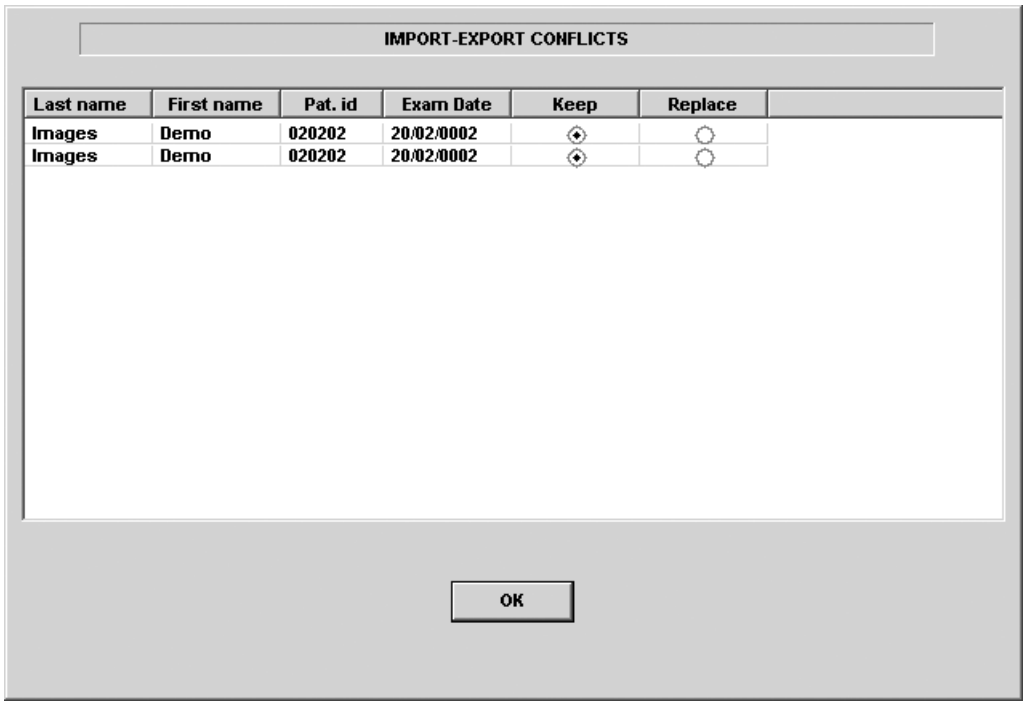


Figure 8-33: The Export/Import conflict window

Press **OK** to resume import.
A progress indicator is displayed. When done a status window is displayed showing the number of patient records that have been successfully imported.

10. Press **OK**.
    A check mark is displayed in the *Copied field* in the *Import patient window* for each item imported.
    A status message is displayed for each item imported. Make sure that the operation was successful for each item imported.
11. Press **Done** in the *Import patient window* to complete the process.

DICOM spooler

DICOM spooler displays the current DICOM output jobs. The jobs may be Storage, Print, Modality Performed Procedure Step or Storage Commitment. The DICOM spooler is used for checking the current job's status when a job is saved or when the total spooler status on the right of the *Archive windows* displays an error.

From the DICOM spooler the user can also:

- **Delete** non-active jobs
- **Resend** a job that has failed or is in hold
- **Send** a job that has failed or is in hold, to a new destination.

The job's status displayed in the *DICOM spooler window* can be:

- **Pending**: the job is complete, waiting to be active.
- **In hold**: the job is incomplete, waiting for more images.
- **Append**: the job is connected to the destination device but is waiting for more images (Direct store function).
- **Active**: the job is complete and connected to the destination device.
- **Failed**: the job is complete but one or more images failed to transmit to the destination device.
- **Done**: the job is saved to the destination device. The jobs that are done are removed from the spooler after a while.

Starting the DICOM spooler

Alternative: Press **F4**.

1. On the alphanumeric keyboard, press and hold down the **ALT** key and press **S**.
   The *DICOM spooler window* is displayed (see Figure 8-34).

The *DICOM spooler window* is automatically updated every minute. Press **Refresh** to update the information displayed at any time.

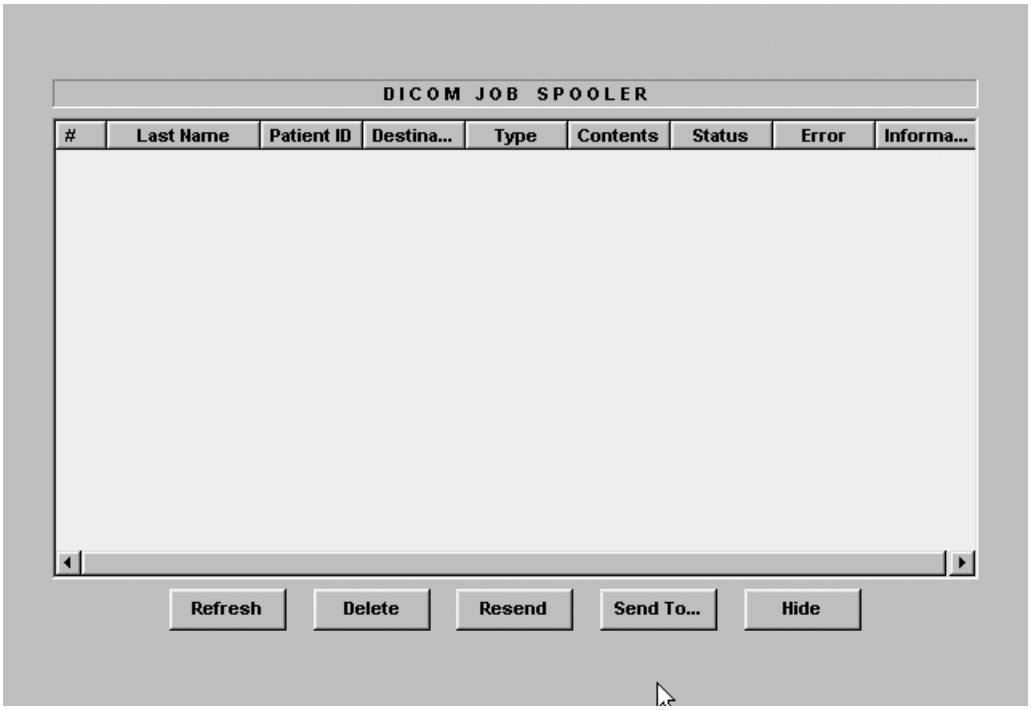


Figure 8-34: The DICOM job spooler window

Deleting a job

Only non-active jobs can be deleted.

1. Trackball to the job to delete in the *DICOM job spooler window*.
2. Press **SELECT**.
3. Trackball to **Delete**.
4. Press **SELECT**.

Resending a job

Only jobs that failed or are in hold can be resent.

1. Trackball to the job to re-send in the *DICOM job spooler window*.
2. Press **SELECT**.
3. Trackball to **Resend**.
4. Press **SELECT**.

Sending a job to a new destination

Only jobs that failed or are in hold can be sent to a new destination.

1. Trackball to the job to send in the *DICOM job spooler window*.
2. Press **SELECT**.
3. Trackball to **Send to...**.
4. Press **SELECT**.
   A dialogue window is displayed.
5. Select the new destination from the *Destination popup menu*.
6. Trackball to **Send**.
7. Press **SELECT**.

Data Backup and restore

The Backup/Restore function enables the user to:

- Copy/Restore the patient archive (patient data and reports).
- Move images from the local harddrive to MO disks.
- Copy/Restore the system configuration.

To minimize accidental loss of data, perform backup of the patient archive (patient data and reports) stored on the local harddrive at least **once a week**.

WARNING

GE Medical Systems is not responsible for lost data if the suggested backup procedures are not followed and will not aid in the recovery of lost data.

There is no backup function for the images (no creation of a safety copy). For long-term storage, images should be moved to MO disks when performing backup as described below.

CAUTION

DO NOT use the local harddrive for long-term image storage.

The backup of the patient archive on the harddrive and the system configuration is done from the configuration management package as described on page 329.

Data from Backup/Restore disks may be restored to the local harddrive using the Restore procedure as described on page 332.

Only users with administration rights (see page 449) have access to the backup/Restore function.

Backup procedure

△
CAUTION

Use a blank dedicated MO disk when doing a backup. This MO disk should only be used for backup/restore purpose (Do not use this MO disk when doing Export or Save as.). The backup procedure will OVERWRITE the existing data on the MO disk.

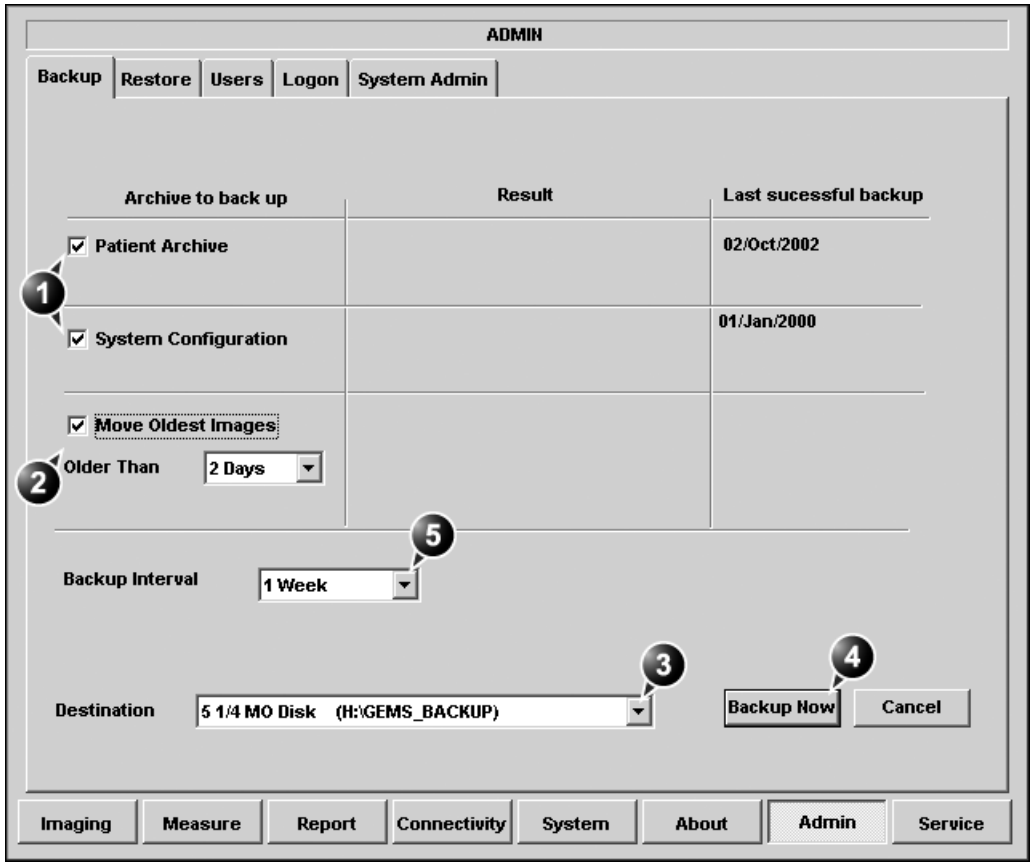
If moving images, make sure to have enough formatted MO disks before disponible.

When formatting the MO disk, give it a logical name and make sure to physically label the disk with the mention "Backup". A labelling convention should be followed so that each MO disk gets a unique label.

1. Insert a dedicated formatted (see page 435) MO disk in the MO drive.
2. Press **CONFIG** (**F2**) on the alphanumeric keyboard.
   The *Log In window* is displayed asking for operator ID and password.
3. Select the user with administration rights and enter the password.
4. Select **Log on**.
   The *Setup dialogue window* is displayed.
5. Select the *Admin setup category*.
   The *Backup sheet* is displayed (Figure 8-35).
6. Select:
   - **Patient archive** to backup patient records and reports.
   - **System setting** to copy system settings and user presets. The system configuration backup can be used to configure several Vivid 7/Vivid 7 PRO units with identical presets, providing the units have the same software version.
   - **Move oldest images** to move images from the local harddrive onto MO disks. Adjust the time span next to **Older than** to move images older than that setting.
7. Select the MO disk as destination.
8. Press **Backup Now**.
   - The system is checking that the MO disk is inserted. If not, a dialogue window is displayed prompting the user to insert a MO disk. Press **OK** to resume backup.
   - The system is checking that the MO disk is formatted. If not, a dialogue window is displayed prompting the user to format the disk.
   - The system is checking the available space on MO disk for the patient archive. If there is not sufficient free space

a dialogue window is displayed. Press **OK**, the media is ejected and insert a new formatted MO disk.

A progress dialogue is displayed showing the current operation being performed.
If the amount of data exceeds the capacity of the MO disk the user is prompted to insert a new (formatted) MO disk.
At the end of the process a status for each item is displayed in the *Result column*.
If errors occur during backup, a list of the patient records/ examinations that could not be backed up is displayed.



1. **Select the item to backup**
2. **Select and adjust the Move images function**
3. **Select the MO disk as backup destination**
4. **Start backup**
5. **Adjust the backup reminder**

Figure 8-35: The Backup sheet

Set up backup reminder

1. In the *Backup sheet*, select the time interval (or none) for the backup reminder next to **Backup interval**.
   When the backup reminder time expires a reminder is displayed when starting the system to prompt the user to take a backup.

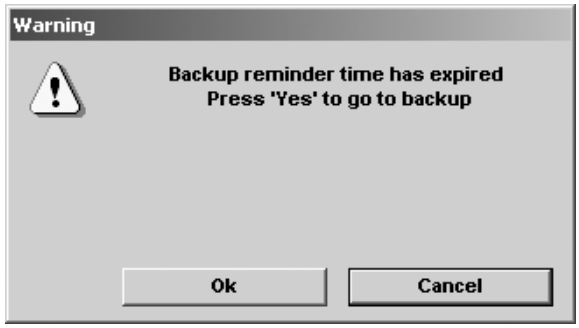


Figure 8-36: The Backup reminder prompt

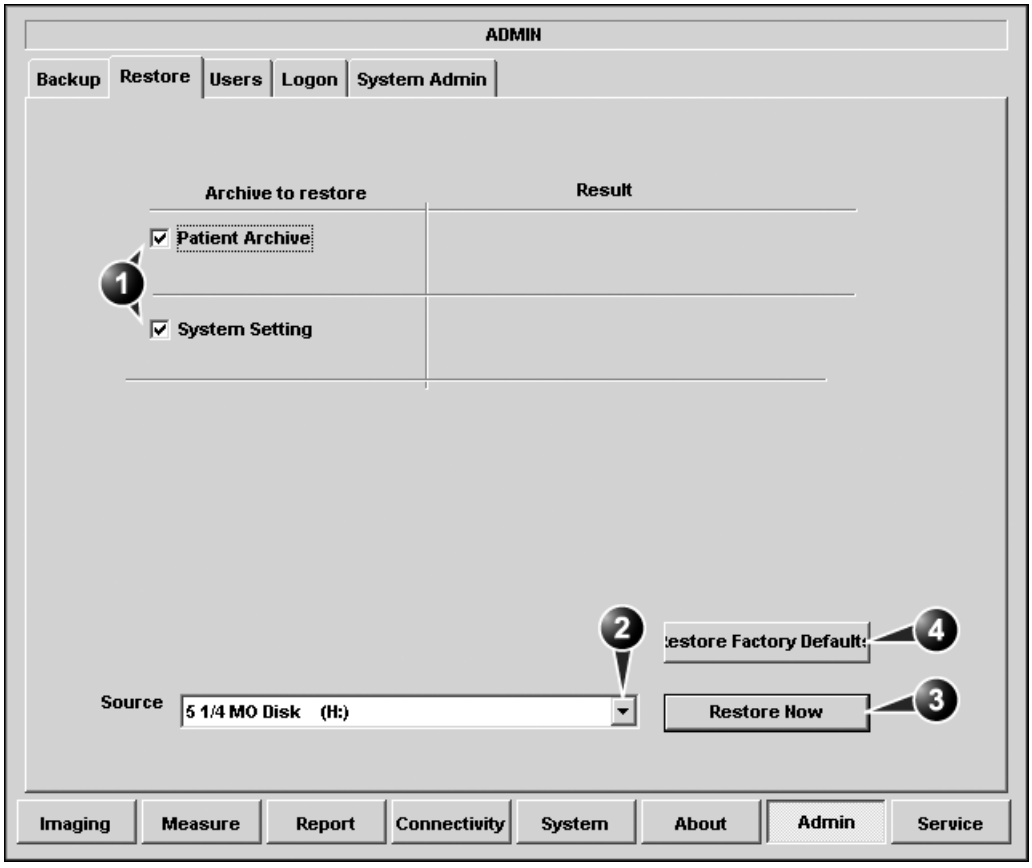
Restore procedure

1. Insert the Backup/Restore MO disk in the MO drive.

△
CAUTION

The Restore procedure will OVERWRITE the existing database on the local harddrive. Make sure to insert the right MO disk.

2. Press **CONFIG** (**F2**) on the alphanumeric keyboard.
   The *Log In window* is displayed asking for operator ID and password.
3. Select the user with administration rights and enter the password.
4. Select **Log on**.
   The *Setup dialogue window* is displayed.
5. Select the *Admin setup category*.
6. Select the *Restore sheet* in the *Admin setup category* (Figure 8-37).
7. Select:
   - **Patient archive** to restore patient records and reports.
   - **System setting** to restore/copy system settings and user presets.
8. Make sure that the Backup/Restore MO disk is inserted in the MO drive and selected as the source.
9. Press **Restore Now**.
   The process status for each item is displayed in the *Result column*.



1. **Select the item to restore**
2. **Select the Backup/Restore disk**
3. **Start restoring data**
4. **Reset the system setting to factory default.**

Figure 8-37: The Restore setup sheet

Chapter 9
Report

This chapter includes the following information:

• Introduction 336
• Creating a report 337
- • Working with the report function 337
- • To print a report 339
- • To save a report 339

• Direct report 341
- • Creating comments 341
- • Creating pre-defined text inputs 343

• Report designer 344
- • Accessing the Report designer 344
- • Report designer overview 345
- • Designing a report template 348
- • Saving the report template 353

Introduction

The Vivid 7/Vivid 7 PRO system enables the generation of patient reports, based on the examination performed and the analysis that were made during the examination. The reports are generated using the data that is stored in the system, using pre-selected templates.

Saved reports are *read-only*. Therefore it is recommended that the data be carefully reviewed before the report is created. Use the worksheet (see page 230) to facilitate the review and adjustment of data before generating a report. The final report can be printed on a regular laser printer.

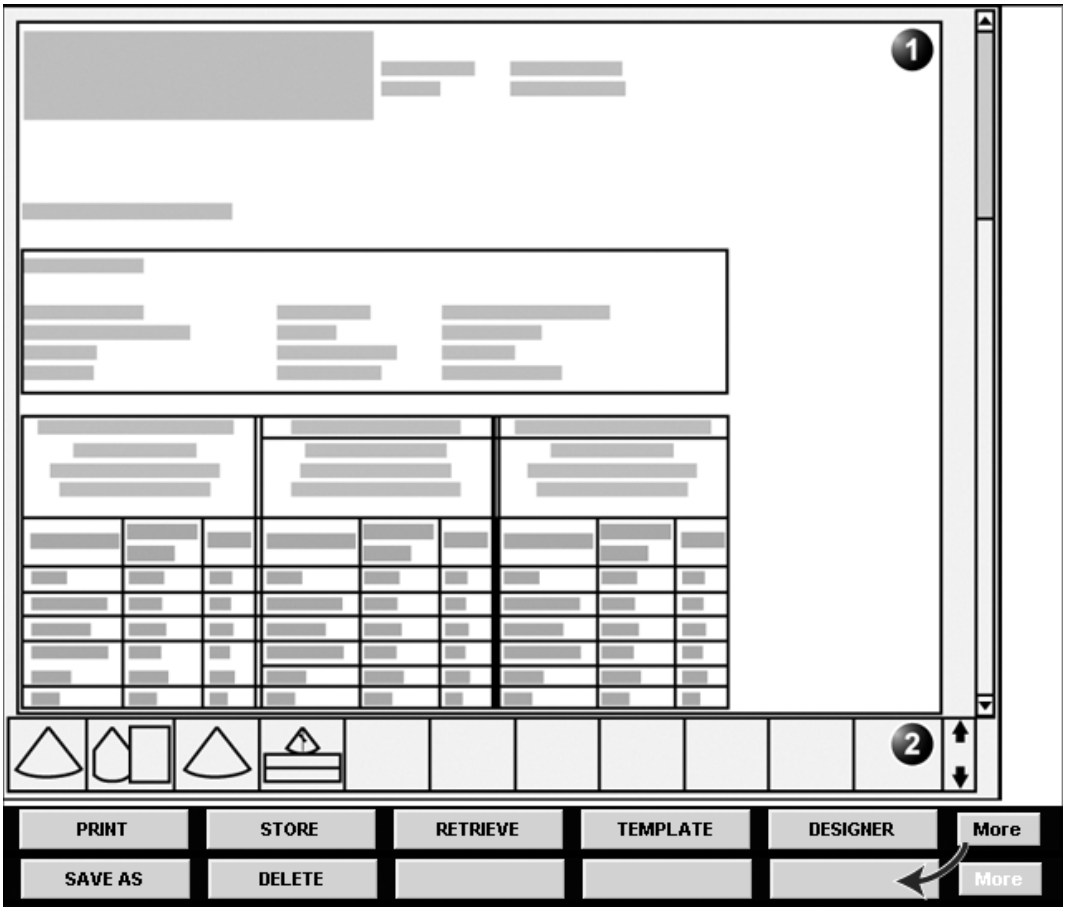
Creating a report

Reports summarize data obtained in the examination. They can contain data and images.

Once generated, the report can be viewed, images can be added and the patient's personal data can be modified. The examination data itself cannot be changed.

Working with the report function

1. Press **REPORT**.
   The default template for the current examination is displayed (see Figure 9-1). The information entered during the creation on the patient record is automatically filled in (e.g. demographic, Diagnosis, Comments...etc.). The report entries, such as **Name**, **Date of Birth**, **Diagnosis** and so on are hot linked to the original screen from which the data was taken. This data can be modified in the report by selecting the heading.



1. **Report for the current examination**
2. **Clipboard with images from the current examination**
3. **Assignable keys**

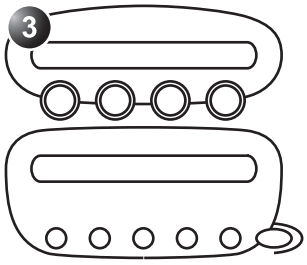


Figure 9-1: The Report screen and assignables

To change patient information

1. Trackball to heading of the information to change.
   The trackball marker is changed to a hand with pointing finger.
2. Press **SELECT** on the *Trackball area*.
   The original location of the data is displayed.
3. Change the information entered if required.
4. Press **REPORT** when completed.

To choose another report template

1. Press the assignable **TEMPLATE**.
   A list of available templates is displayed.
2. Trackball to the desired template.
3. Press **SELECT** on the *Trackball area*.
   The selected template is displayed on the screen.

To add an image to the report

Images are inserted in the report by dragging a selected image from the clipboard into an *Image container* in the report.

1. Trackball to the Image of interest in the *Image clipboard*.
2. Press and hold down the **SELECT** key and using the trackball, drag the selected image in the *Image container* in the report.
3. Release the **SELECT** key.

To print a report

1. Press **PRINT**.
   The report is printed on the default printer. A status window is displayed showing the printing process.

To save a report

Only members of the user group “Cardiologist” are allowed to store a report (see page 449).

1. Press **STORE**.
   The report is stored in the Report archive.
   A confirmation window is displayed when completed.
2. Press **OK**.

Alternative storage

Reports can also be saved in a user-defined locations in the following formats:

- **Compiled HTML (.CHM) files**: readable from any web browser.
- **Portable Document Format (.PDF) files**: readable with Adobe Acrobat reader.

1. Press **MORE**.
   The additional controls are displayed (Figure 9-1).
2. Press **SAVE AS**.
   The *Save as dialogue window* is displayed.
3. Select the destination folder from the *Save in pull down menu*.
   The *Report archive folder* is selected by default.
4. Enter a file name.
5. Select **PDF** or **CHM** format from the *Save as type pull down menu*.
6. Press **SAVE**.

Retrieving an archived report

1. Press **RETRIEVE**.
   A list of the available reports for the actual examination is displayed.
2. Trackball to the report to retrieve.
3. Press **SELECT**.

Direct report

Direct report enables the user to insert comments at any time during the examination that will be part of the final report.

Direct report provides also an overview over the measurements completed.

Creating comments

1. Press **UPDATE MENU**.
2. Select **Direct report** (see Figure 9-2).
3. In the *Direct report screen*, select the comment type.
4. Type your comments in the *Text field*.

1. **Open Direct report**
2. **Select the type of information**
3. **Create/insert pre-defined text**
4. **Text field**
5. **List of measurements completed**
6. **Exits the Direct report**

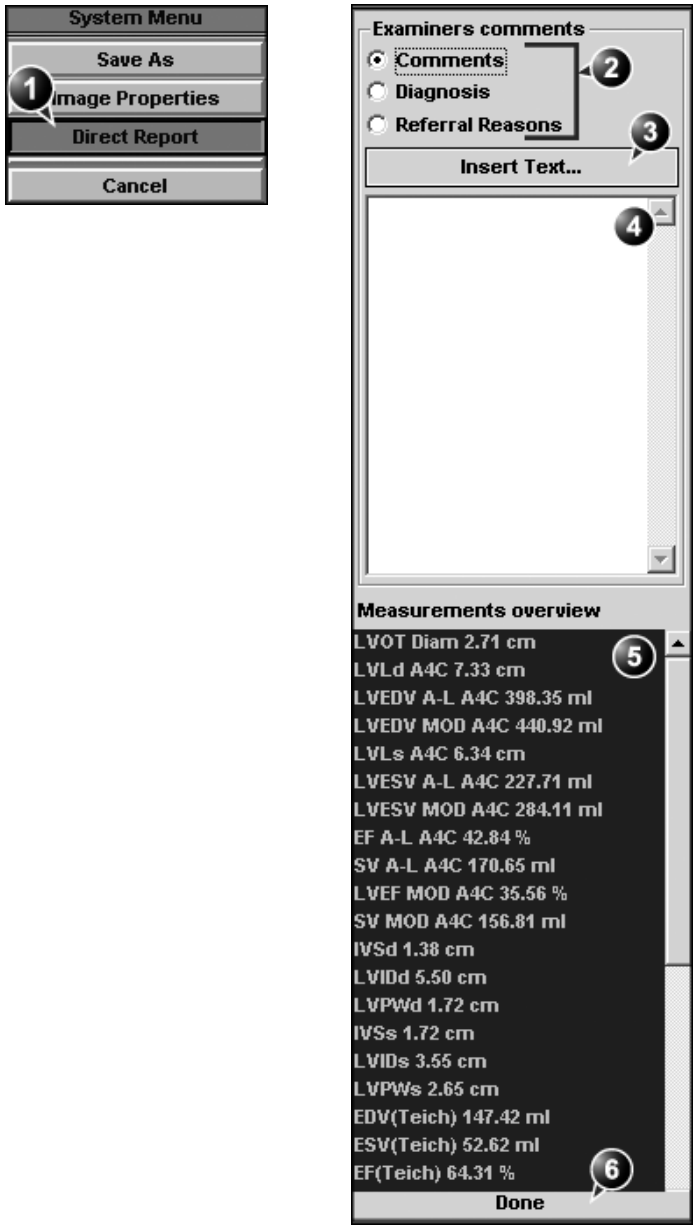


Figure 9-2: The Direct report

Inserting pre-defined text input

1. Select the insertion point in the *Text field*.
2. Select **Insert text**.
   The *Insert text window* is displayed (see Figure 9-3).

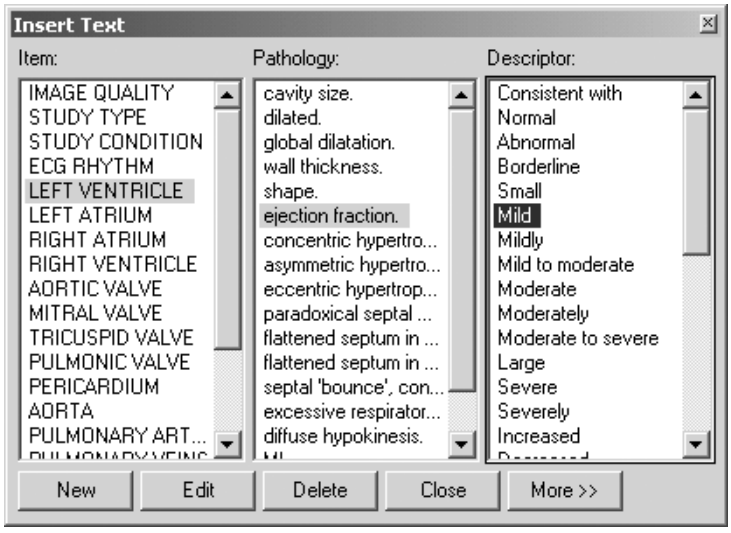


Figure 9-3: The Insert text window

   The pre-defined text list is organized in a three level hierarchy. Selecting one item in column one (**Item**) displays a specific pre-defined text list in column two (**Pathology**) related to the item selected. Likewise selecting a pathology term in column two displays a specific pre-defined text list in column three (**Descriptor**) related to the pathology selected.
3. Navigate through the pre-defined text list by selecting items in the columns and double-click on the desired pre-defined text to be inserted. If a descriptor is selected, both the descriptor and the pathology texts are inserted.
   Press **More>>** to display the full text for the selected term.

Creating pre-defined text inputs

This feature is described in 'The Comment texts sheet' on page 420.

Report designer

The Report designer software package enables the user to create report templates that best suit its needs.

Designing a report template consists of choosing the information to display in the report (e.g. header, footer, logo, patient information, images, measurements...etc.) and arrange it in the report viewer.

The Report designer function is based on the information container concept: each type of information is included within a container with parameters that can be configured (size, color, font properties, information to display...etc.).

Accessing the Report designer

1. Press **REPORT** on the Control panel.
   The *Report screen* is displayed.
2. Press **Designer** in the *Report screen*.
   The *Report designer screen* is displayed with the selected template in the *Report template design area* (see Figure 9-4).

Report designer overview

The Report designer screen

1. **Menu bar**
2. **Report template design area**

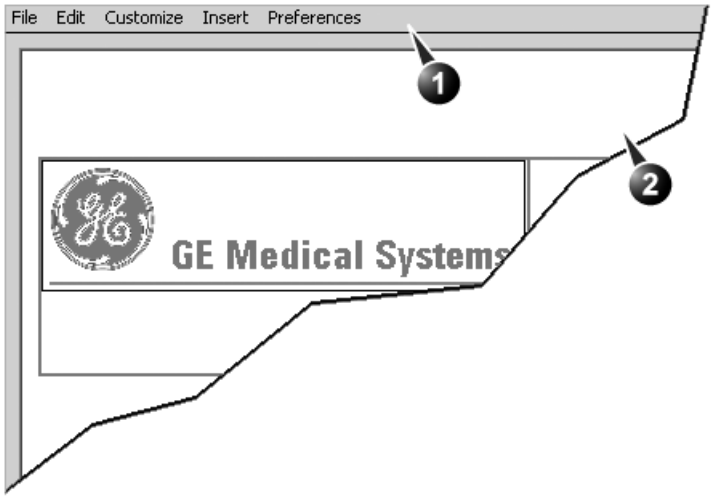
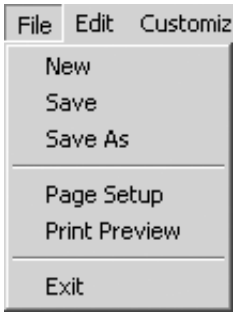


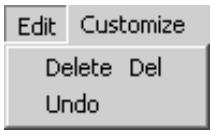
Figure 9-4: The Report designer screen

The menu bar

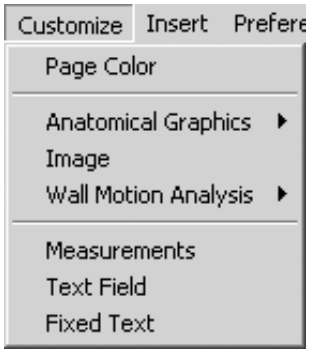
The File menu

Menu	Description
	• **New**: display an empty template. • **Save**: save the template using the same name and exits the Report designer. Factory report templates cannot be overwritten. • **Save as**: save the template using a new name and exits the Report designer. • **Page setup**: display the printing version of the template where the user can adjust parameters specific to the paper version (i.e margins). • **Print Preview**: display a print preview of the report template. • **Exit**: exit the Report designer and returns to the report function. The user can choose whether to save the updates or restore the original template.

The Edit menu

Menu	Description
	• **Delete**: remove the selected object from the report template. • **Undo**: restore the previous state of the report template.

The Customize menu

Menu	Description
	• **Page Color**: sets the default background color for the template page. • **Anatomical graphics**: select and insert an anatomical graphic (cardiac, vascular or TEE). • **Image**: create a container for the display of ultrasound images. • **Wall motion analysis**: insert a container for the display of Stress Echo analysis results (cut planes Bull's eye and scoring table). • **Measurements**: insert a container for the display of measurements and calculations. When creating a measurement container, the user is prompted through a configuration procedure enabling the selection of mode specific measurements and/or calculations. • **Text field**: insert a container where the user can write in the report. • **Fixed text**: insert a container with static text. The text typed during the creation of the container will be displayed in the report.

The Insert menu

Menu	Description
	• **Page Break**: insert a new page in the report template. • **Table**: configure and insert a table in the report template. • **Logo**: select and insert a logo to the report template. • **Archive info**: select and insert data from the following categories: Patient information Exam information Site information

Designing a report template

The different type of information to be included in a report are grouped in information containers. Designing a report template consists in inserting and configuring the different information containers in the template page in an ordered manner.

Starting template designing

1. Start the Report designer (see page 344).
2. Press **File** and select **New** to display a default page or use the current report template as basis template.

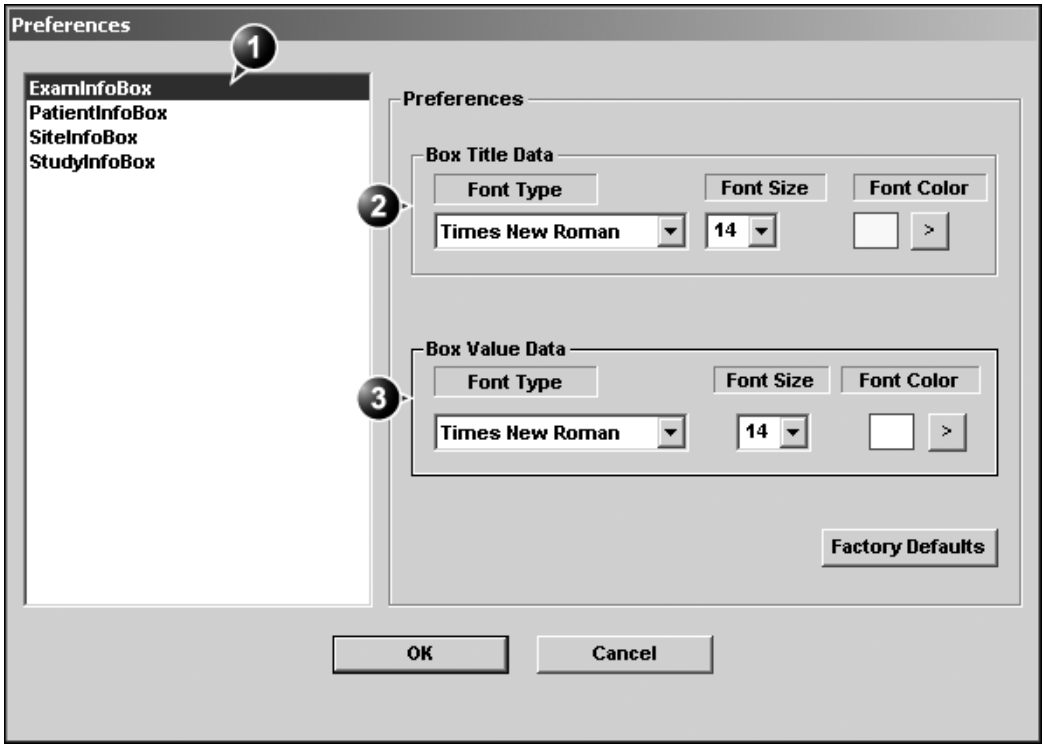
Setting the layout preferences

Adjusting the default fonts and container background colors

1. Press **Preferences**.
   The *Preferences dialogue window* is displayed (see Figure 9-5).
2. Select a container and adjust the parameters as desired.
3. Repeat step 2 for each information container.

Adjusting the report page color background

1. Press **Customize** and select **Page Color**.
   The *Color selection window* is displayed.
2. Select the desired color.
3. Press **OK**.



1. **Select a container**
2. **Adjust the container's title font parameters**
3. **Adjust the container's core text font parameters**

Figure 9-5: The Preferences dialogue window

Inserting an information container in the report template body

Procedure for a single insertion

1. Press the **Left mouse button** at the desired insertion point in the *Report template design area*.
2. Press **Customize** or **Insert** and select the actual information container.
   The *Container properties window* is displayed.
3. Adjust the parameters as required.
4. If the default layout parameters have to been changed, press **Box Properties**. Adjust as desired (see page 351) and press **OK**.

5. Press **OK** in the Container properties window.
   The container is added to the template.

Procedure for multiple side by side insertion

To insert two or more information containers side by side, a table with multiple cells must be created first.

1. Press the **Left mouse button** at the desired insertion point in the *Report template design area*.
2. Press **Insert** and select **Table**.
   The *Container properties window* is displayed (see Figure 9-6).
3. Adjust the parameters as desired.
4. Press **OK**.
   The container is displayed in the template.
5. Insert the information containers of interest within each cell as described in the previous section.

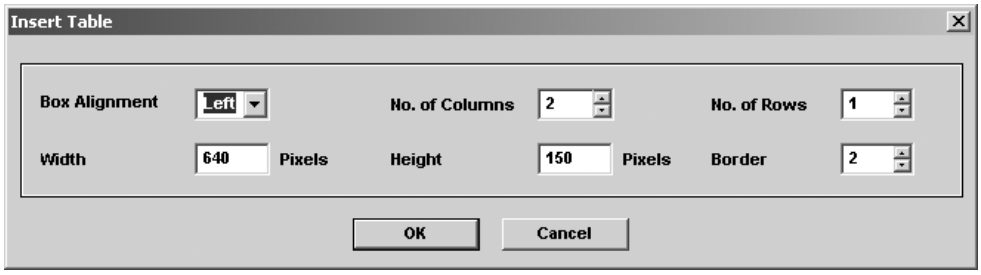


Figure 9-6: The Table properties window

Editing the information container

Resizing the information container

1. Move the **Mouse cursor** over the border of the container to resize.
   The mouse cursor is changed to a cross ✣.
2. Press **Left mouse button** once.
   The container is displayed with anchor squares on the sides and at the corners.
3. Resize the container by dragging from the anchor points.

Editing the information container properties

Modifying the container's specific properties

1. Move the **Mouse cursor** over the border of the container to edit.

   The mouse cursor is changed to a cross ✣.
2. Double-click on the **Left mouse button**.
   The *Container properties window* is displayed.
3. Adjust the parameters specific to the selected container.

Modifying the layout properties

1. Press **Box properties** in the *Container properties window*.
   The Box properties window is displayed (see Figure 9-7).
2. Set the options as desired.
3. Press **OK**.

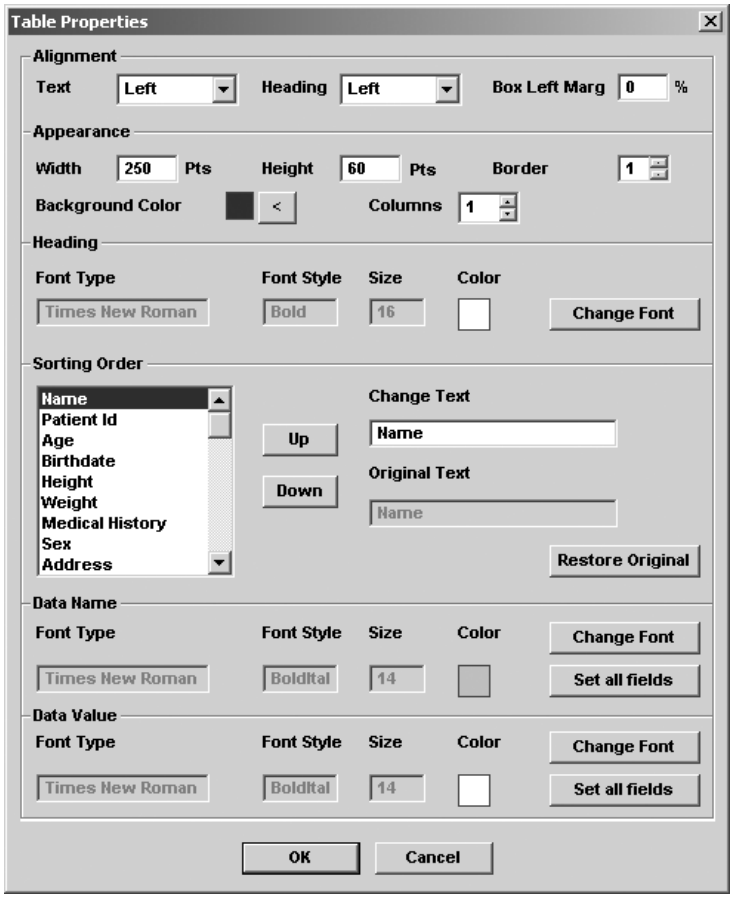


Figure 9-7: The Box properties window (example)

Inserting a new page

1. In the template, position the Mouse cursor at the insertion point.
2. Press the **Left mouse button**.
3. Press **Insert** and select **Page Break**.

Saving the report template

Replace an existing template

Factory templates cannot be overwritten.

1. Press **File** and select **Save**.
   A dialogue window is displayed asking for confirmation.
2. Select:
   - **Yes** to save the report template
   - **No** to discard the report template
   - **Cancel** to go back to the Report designer without saving the report template.

   Selecting **Yes** or **No** will quit the Report designer and display the Report function.

Save existing template with a new name

1. Press **File** and select **Save as**.
   The *Save as template window* is displayed.

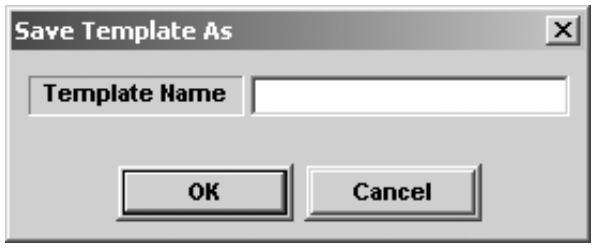


Figure 9-8: The Save as template window

2. Enter a name for the template.
3. Press **OK**.
   The template is saved and the *Report screen* is displayed.

Chapter 10
Probes

This chapter includes the following information:

• Probe overview 356
- • Supported probes 356
- • Probe orientation 362
- • Probe labelling 362

• Probe Integration 364
- • Connecting the probe 364
- • Activating the probe 366
- • Disconnecting the probe 367

• Care and Maintenance 368
- • Planned maintenance 368
- • Inspecting the probe 369
- • Cleaning and disinfecting probes 370

• Probe safety 373
- • Electrical hazards 373
- • Mechanical hazards 373
- • Biological hazards 374

• Biopsy 375
- • Precaution concerning the use of biopsy procedures 375
- • Preparing the Biopsy guide attachment 376
- • Displaying the Guide zone 379
- • Biopsy needle path verification 380
- • Starting the biopsy procedure 380
- • Cleaning, disinfection and disposal 380

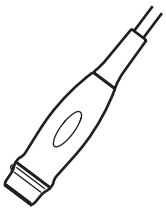
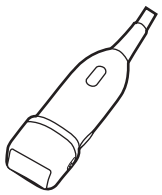
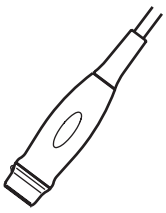
Probe overview

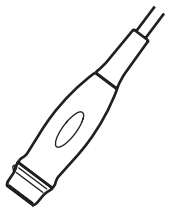
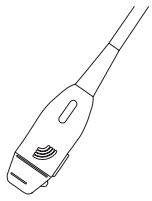
The Vivid 7/Vivid 7 PRO ultrasound unit supports four types of probes:

- Phased Array Sector
- Linear Array
- Curved Array (Convex)
- Continuous Wave Doppler

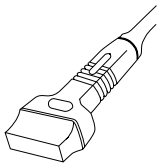
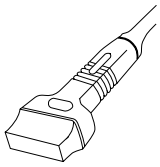
Supported probes

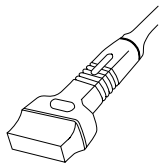
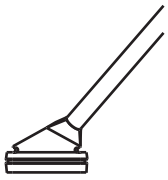
Phased Array Sector probes

Probe	Mode	Intended use	Technical data
3S 	2D mode M-Mode Color Flow CW Doppler PW Doppler	• Cardiology • Coronary • Transcranial • Abdomen • Pediatric	Frequency: 1.5 - 3.6 MHz Foot print: 18 x 24 mm
M3S 	2D mode M-Mode Color Flow CW Doppler PW Doppler	• Cardiology • Coronary • Transcranial • Abdomen • Pediatric	Frequency: 1.5 - 4.0 MHz Foot print: 20 x 28 mm
5S 	2D mode M-Mode Color Flow CW Doppler PW Doppler	• Cardiology • Coronary • Pediatric	Frequency: 2.2 - 5.0 MHz Foot print: 18 x 24 mm

Probe	Mode	Intended use	Technical data
7S 	2D mode M-Mode Color Flow CW Doppler PW Doppler	• Cardiology • Coronary • Pediatric	Frequency: 3.0 - 8.0 MHz Foot print: 15 x 21 mm
10S 	2D mode M-Mode Color Flow CW Doppler PW Doppler	• Cardiology • Coronary • Pediatric	Frequency: 4.0 - 12.0 MHz Foot print: 10 x 14 mm

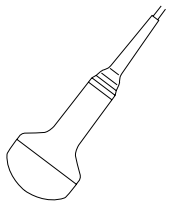
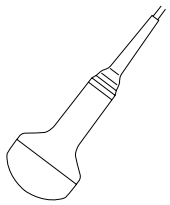
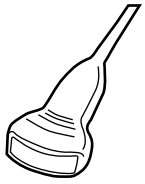
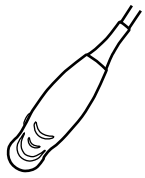
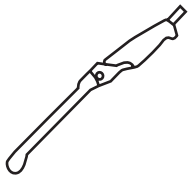
Linear Array probes

Probe	Mode	Intended use	Technical data
7L 	2D mode M-Mode Color Flow CW Doppler PW Doppler	• Peripheral vascular • Small parts	Frequency: 3.2 - 7.5 MHz Foot print: 17 x 58 mm
10L 	2D mode M-Mode Color Flow CW Doppler PW Doppler	• Small parts • peripheral vascular	Frequency: 4.0 - 11.0 MHz Foot print: 17 x 49 mm

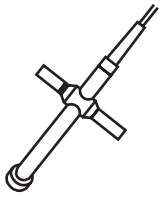
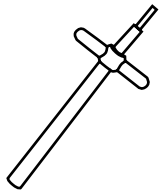
Probe	Mode	Intended use	Technical data
12L 	2D mode M-Mode Color Flow CW Doppler PW Doppler	• Small parts • peripheral vascular	Frequency: 5.0 - 11.5 MHz Foot print: 17 x 49 mm
M12L[a)] 	2D mode M-Mode Color Flow CW Doppler PW Doppler	• Carotid • Superficial	Frequency: 5.0 - 13.0 MHz Foot print: 10 x 45 mm
i8L 	2D mode M-Mode Color Flow CW Doppler PW Doppler	• Cardiac intraoperative	Frequency: 5.0 - 8.0 MHz Foot print: 16 x 44 mm
i13L 	2D mode M-Mode Color Flow CW Doppler PW Doppler	• Cardiac intraoperative	Frequency: 8.0 - 13.0 MHz Foot print: 10 x 28 mm

[a)] Vivid 7 only

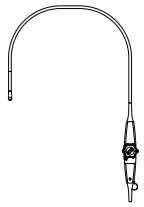
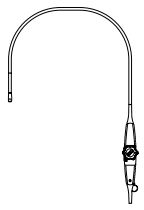
Curved Array (Convex) probes

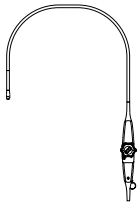
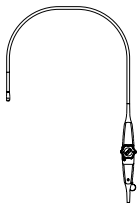
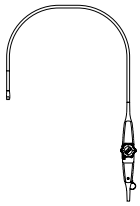
Probe	Mode	Intended use	Technical data
3.5C 	2D mode M-Mode Color Flow CW Doppler PW Doppler	• Abdomen • Fetal Heart • Obstetrics • Pelvic • Renal	Frequency: 2.4 - 5.0 MHz Foot print: 18 x 64 mm FOV: 58 degrees
5C 	2D mode M-Mode Color Flow CW Doppler PW Doppler	• Abdomen • Fetal Heart • Obstetrics • Pelvic • Renal	Frequency: 3.6 - 8.0 MHz Foot print: 17 x 58 mm FOV: 73 degrees
M7C 	2D mode M-Mode Color Flow CW Doppler PW Doppler	• Abdomen	Frequency: 3.0 - 8.0 MHz Foot print: 18 x 55 mm FOV: 75 degrees
8C 	2D mode M-Mode Color Flow CW Doppler PW Doppler	• Abdomen	Frequency: 4.0 - 10.0 MHz Foot print: 23 x 10 mm FOV: 133 degrees
E8C 	2D mode Color Flow CW Doppler PW Doppler	• Fetal Heart • Obstetrics • Pelvic	Frequency: 4.0 - 10.0 MHz Foot print: 23 x 10 mm FOV: 133 degrees

Doppler probe

Probe	Mode	Intended use	Technical data
2D (P2D) 	CW Doppler	• Cardiology	Frequency: 2.0 MHz
6D (P6D) 	CW Doppler	• Carotid	Frequency: 6.0 MHz

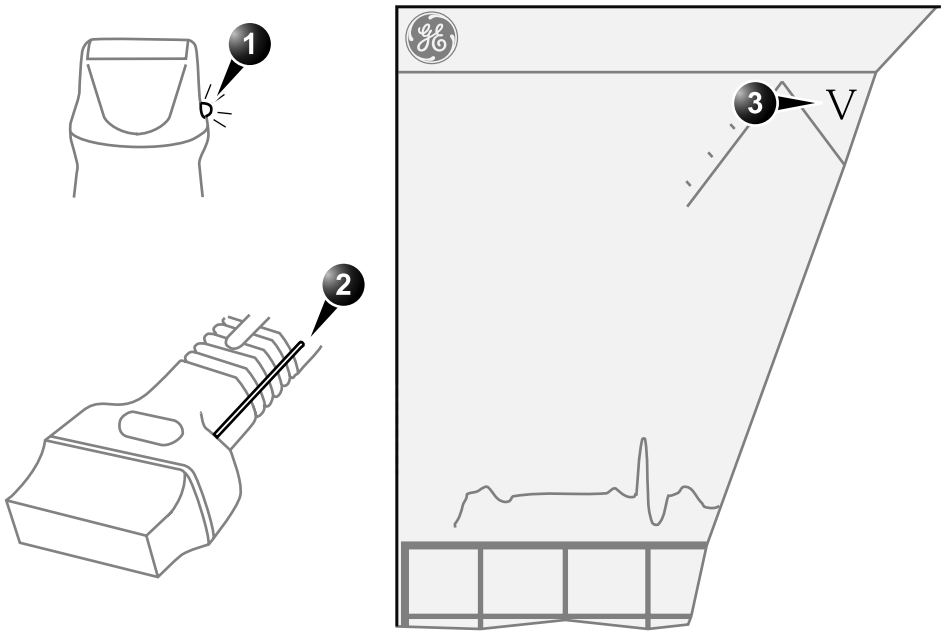
Multiplane Transesophageal Phased Array probe

Probe	Mode	Intended use	Technical data
6T 	2D mode M-Mode Color Flow CW Doppler PW Doppler	• Transesophageal Cardiology	Frequency: 2.9 - 6.7 MHz
7T 	2D mode M-Mode Color Flow CW Doppler PW Doppler	• Transesophageal Cardiology	Frequency: 3.0 - 8.0 MHz

Probe	Mode	Intended use	Technical data
9T 	2D mode M-Mode Color Flow CW Doppler PW Doppler	• Transesophageal pediatric Cardiology	Frequency: 3.3 - 10.0 MHz
5T PAMPTE 	2D mode M-Mode Color Flow CW Doppler PW Doppler	• Transesophageal Cardiology	Frequency: 2.9 - 6.7 MHz
8T 	2D mode M-Mode Color Flow CW Doppler PW Doppler	• Transesophageal pediatric Cardiology	Frequency: 3.3 - 8.0 MHz

Probe orientation

Some probes are provided with a green light (LED) orientation marking near their head (see Figure 10-1). Probes which do not have a LED have an indentation (notch) for orientation on the probe housing. This LED, or notch, corresponds with the **V** mark on the scanning screen. The **V** mark indicates the orientation of the probe to the scan.



1. **LED**
2. **Notch**
3. **V-mark on screen: indicates the orientation of the probe to the scan.**

Figure 10-1: Orientation marking on probe and on screen

Probe labelling

Each probe is labelled with the following information:

- Name of distributor and manufacturer
- Operating frequency
- Model number
- Probe serial number
- Year of manufacture

The probe name displayed on both the probe housing and the connector can be read when the probe is connected.

1. **CE mark**
2. **Probe name**

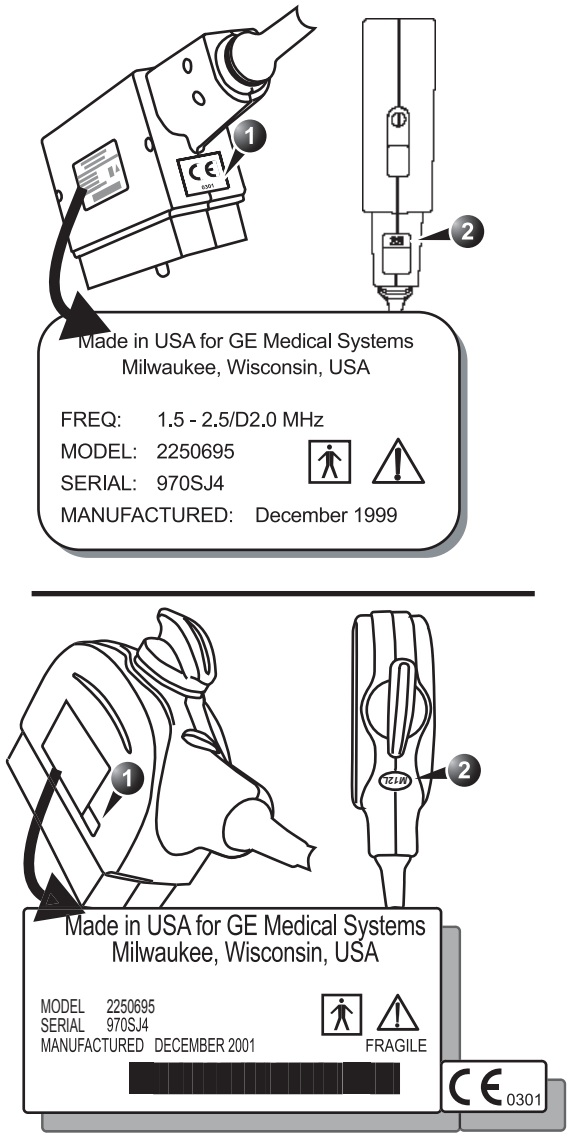


Figure 10-2: Probe labelling (examples)

Probe Integration

This section covers:

- Connecting the probe
- Activating the probe
- Disconnecting the probe

Connecting the probe

Probes can be connected at any time, whether the unit is on or off.

CAUTION

Do not allow the probe head to hang freely. Impact to the probe head may result in irreparable damage.

WARNING

Do NOT touch the patient and any of the connectors on the ultrasound unit simultaneously, including ultrasound probe connectors.

To connect a probe:

1. Hold the probe connector vertically with the cable pointing upward.
2. Turn the connector locking handle to the horizontal position.
3. Align the connector with the probe port and carefully push into place.
4. Rotate the locking handle to the full vertical position to lock in place.
5. Position the probe cable so that it is not resting on the floor.

CAUTION

Take the following precautions with the probe cables:

- Keep free from the wheels.
- Do not bend.
- Do not cross cables between probes.

Connecting the PAMPTE or the 6Tv probe

△
CAUTION

Transesophageal probes require a special handling. Refer to the user documentation enclosed with these probes.

The PAMPTE and the 6Tv probes are equipped with a Vivid Five connector. To connect the these probes on the Vivid 7/ Vivid 7 PRO, an adaptor must be used (see Figure 10-3).

To connect the PAMPTE or 6Tv probe:

1. Turn the probe connector locking handle to the horizontal position.
2. Align the connector with the adaptor port and carefully push into place.
3. Rotate the probe connector locking handle to the full vertical position to lock the probe connector and the adaptor together.
4. Ensure that the locking handle on the adaptor is in up position (see Figure 10-3).
5. Align the adaptor with the probe port and carefully push into place.
6. Move the locking handle to the down position to lock in place (see Figure 10-3).
7. Position the probe cable so that it is not resting on the floor.

1. **PAMPTE or 6Tv probe connector in**
2. **To Vivid 7/ Vivid 7 PRO probe port**
3. **Unlocked position**
4. **Locked position**

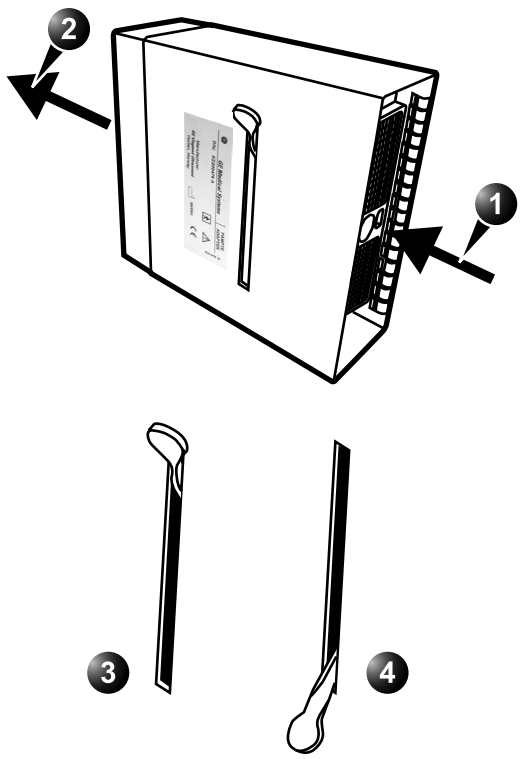


Figure 10-3: The PAMPTE probe adaptor

Activating the probe

When a probe is connected to the unit it is automatically detected.

To select a probe and an application:

To change application without changing the current probe, press **APPL.** *on the control panel.*

1. Press **PROBE** on the control panel. A list of the connected probes will pop up.
2. Trackball to the desired probe.
   An application menu for the desired probe is then listed.
3. Trackball to the desired application
4. Press **SELECT** to launch the application.

△
CAUTION

Make sure that the probe and application names displayed on the screen correspond to the actual probe and application selection.

Check that the correct TI category is displayed (see 'Thermal Index' on page 471). TIB must be displayed when a fetal application is selected.

Disconnecting the probe

To disconnect probes:

1. Rotate the lock handle counter-clockwise to the horizontal position to unlock the connector.
2. Remove the connector from the port.
3. Ensure that the probe head is clean before placing the probe in its storage case.

The probes that are not connected to the unit should be stored in their storage case.

Care and Maintenance

This section covers:

- Planned maintenance
- Probe inspection
- Probe cleaning
- Probe disinfection

Planned maintenance

△
CAUTION

Improper handling can lead to early probe failure and electric shock hazards.

DO follow the specific cleaning and disinfection procedures provided in this chapter and the germicide manufacturers instructions.

Failure to do so will void probe warranty.

△
CAUTION

Transesophageal and intraoperative probes require a special handling. Refer to the user documentation enclosed with these probes.

It is recommended to keep a maintenance log and note all probe malfunctions. Follow the maintenance schedule below to ensure optimum operation and safety:

After each use:

- Inspect the probe
- Clean the probe
- If required disinfect the probe

Before each use:

- Inspect the probe

Inspecting the probe

△
CAUTION

If any damage is found, DO NOT use the probe until it has been inspected and released for further use by a GE service representative.

After each use:

1. Inspect the lens, the probe housing and the cable (Figure 10-4.
2. Look for damage that might allow liquid into the probe.

Before each use:

1. Inspect the lens, the probe housing and the cable (Figure 10-4).
2. Look for damage that might allow liquid into the probe.
3. Test the functionality of the probe.

1. **Housing**
2. **Strain relief**
3. **Seal**
4. **Lens**

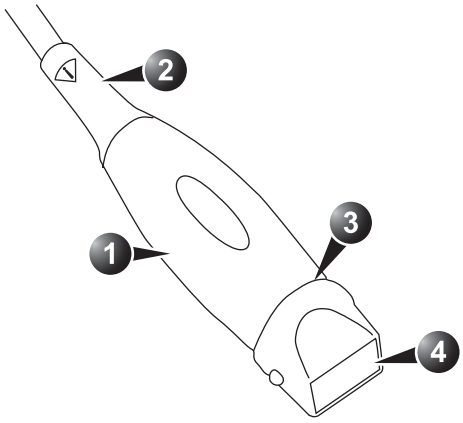


Figure 10-4: Probe parts

Cleaning and disinfecting probes

CAUTION

Transesophageal and intraoperative probes require a special handling. Refer to the user documentation enclosed with these probes.

Cleaning probes

Cleaning procedure

1. Disconnect the probe from the unit.
2. Remove the coupling gel by wiping the probe lens with a soft cloth.
3. Wipe the probe and cable with a soft cloth moisten in a warm soap and water solution (<80^{o}F/27 ^{o}C).
4. Wipe the probe and cable with a soft cloth moisten in clean water (<80^{o}F/27 ^{o}C) until all soap is removed.
5. Wipe dry with a soft towel.

Disinfecting probes

In order to provide users with options in choosing a germicide, GE Medical Systems routinely reviews new medical germicides for compatibility with the materials used in the transducer housing, cable and lens. Although a necessary step in protecting patients and employees from disease transmission, liquid chemical germicides must also be selected to minimize potential damage to the transducer.

Refer to the Probe Care Card enclosed in the probe case for the latest list over compatible germicides and disinfectants.

Low-level disinfection

1. After cleaning, the probe and cable may be wiped with a tissue sprayed with a recommended disinfectant.

Use additional precautions (e.g., gloves and gown) when decontaminating an infected probe.

High-level disinfection

High-level Disinfection destroys vegetative bacteria; lipid & non-lipid viruses, fungi and, depending highly on time of contact, is effective on bacterial spores. This is required for

endocavity (TV,TR,TE) probes after contact with mucosal membrane.

High-level disinfection procedure

Follow the manufacturer's instructions for storage, use and disposal of the disinfection solution.

1. Prepare the germicide solution according to the manufacturer's instructions.

WARNING

Use only germicides that are listed in the Probe Care Card enclosed with the probe. In addition, refer to the local / national regulations.

Do not steam autoclave or subject the probe to Ethylene Oxide (ETO).

2. Place the cleaned dried probe in contact with the germicide for the time duration specified by the manufacturer.

WARNING

Do not immerse the probe in liquid beyond the level specified for that probe (see Figure 10-5).

Never immerse the probe connector or probe adapters in liquid.

The probe should not be exposed to the germicide longer than specified to achieve the desired effect.

DO NOT soak or saturate probes with solutions containing alcohol, bleach, ammonium chloride compounds. In addition TE probes must not be immersed in solutions containing hydrogen peroxide.

3. Rinse the part of the probe which was in contact with the germicide according to the germicide manufacturer's instructions.
4. Wipe dry with a soft towel or air dry the probe.

WARNING

CREUTZFIELD-JACOB DISEASE

Neurological use on patients with this disease must be avoided. If a probe becomes contaminated, there is no adequate disinfecting means.

1. **Fluid level**
2. **Contact face with patient environment**

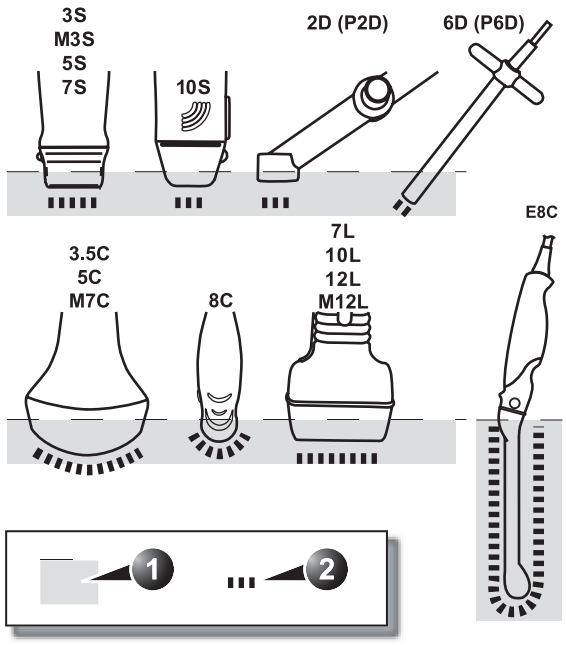


Figure 10-5: Probe immersion levels

Probe safety

This section includes information on hazards to both the user and the equipment, as follow:

- Electrical hazards
- Mechanical hazards
- Biological hazards

Electrical hazards

Probes are driven by electricity, which can injure the patient or user when exposed to contact with conductive solution.

WARNING

Do not immerse the probe into any liquid beyond the level shown in Figure 10-5. Never immerse the probe connector or adaptors into any liquid.

Do not subject the probe to mechanical shock or impact, which may result in cracks or chips in the housing and degrade performance.

Inspect the probe before and after each use, as described on page 369, for damage or degradation to the housing, strain relief, lens and seal.

DO NOT apply excessive force to the probe cable, to prevent insulation failure.

Electrical leakage checks should be performed regularly by a GE service representative or qualified hospital personnel, according to the procedures described in EN 60601-1/IEC 60601-1 §19.

Mechanical hazards

Take precaution to avoid mechanical hazards.

WARNING

Observe immersion levels as displayed in Figure 10-5, page 372.

Inspect probes for sharp edges or rough surfaces that could injure sensitive tissue.

DO NOT bend or pull the cable forcefully, to avoid mechanical shock or impact to the probe.

Biological hazards

△
CAUTION

Transesophageal probes require a special handling. Refer to the user documentation enclosed with these probes.

To minimize disease transmission, legally marketed and sterile pyrogen-free sheaths should be used for each probe recommended for intra-cavity procedures.

Adequate cleaning and disinfection are essential to prevent disease transmission. It is the responsibility of the user to verify and maintain the effectiveness of the infection control procedures in use.

Biopsy

The Vivid 7/Vivid 7 PRO supports biopsy capability for the 3.5C, 10L and 12L probes. The biopsy option is intended for use by a duly licensed physician who has received the appropriate training in biopsy techniques as dictated by current relevant practices, as well as in proper operation of the Vivid 7/ Vivid 7 PRO ultrasound unit.

Precaution concerning the use of biopsy procedures

WARNING

Do not freeze the image during a biopsy procedure. The image must be live to avoid a positioning error.

CAUTION

The use of biopsy devices and accessories that have not been evaluated for use with the equipment may not be compatible and could result in injury.

CAUTION

The invasive nature of biopsy procedures requires proper preparation and technique to control infection and disease transmission. Equipment must be cleaned as appropriate for the procedure prior to use.

- Follow the probe cleaning and disinfection procedures and precautions to properly prepare the probe.
- Follow the manufacturer’s instructions for the cleaning of biopsy devices and accessories.
- After use, follow proper procedures for decontamination, cleaning, and waste disposal.

Improper cleaning methods and the use of certain cleaning and disinfecting agents can cause damage to the plastic components that will degrade imaging performance or increase the risk of electric shock.

Preparing the Biopsy guide attachment

The 3.5C, 10L and 12L probes have an optional biopsy kit specific for each probe. The biopsy kit consists of:

- One reusable non-sterile bracket
- Five disposable sterile Ultra-Pro II™ Needle guide kits (Civco Medical Instruments Co, Inc.) consisting of:
  - Two sets with needle inserts covering gauge size 14 through 23 (2.1mm to 0.6mm)
  - One sterile sheath
  - Two rubber bands
  - gel
- One reusable needle guide
- Instructions

In addition sterile Ultra-Pro II™ Needle guide kits can be ordered as replacement kit.

⚠ WARNING

Read the following instructions and the user's guide for the Ultra-Pro II™ Needle Guide kit before using the biopsy equipment.

Bracket attachment procedure

1. Identify the appropriate biopsy guide bracket as shown in Figure 10-6.

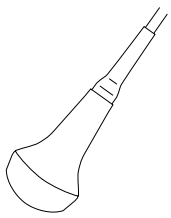
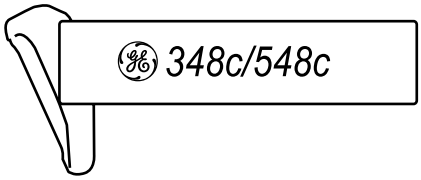
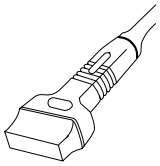
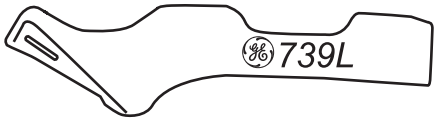
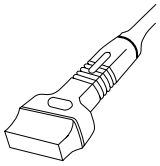
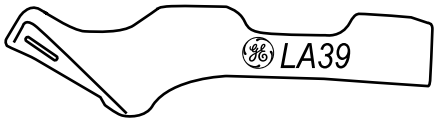
Probe	Biopsy
3.5C 	
10L 	
12L 	

Figure 10-6: The biopsy bracket for the 3.5, 10L and 12L probes

2. Orient the bracket so that the needle clip attachment is on the same side as the probe orientation mark (notch), see Figure 10-7.

1. **Bracket**
2. **Bracket label**
3. **Probe label**
4. **Probe orientation mark**

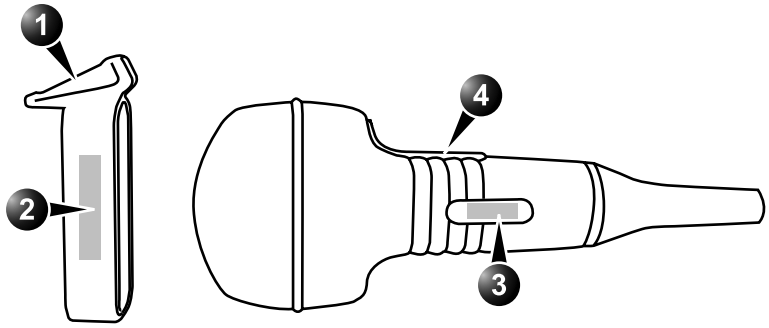


Figure 10-7: Probe/bracket alignment

3. Attach the biopsy bracket to the probe by sliding the bracket over the end of the probe until it clicks or lock into place. Make sure the bracket is firmly attached to the probe.

Placing the probe and bracket into the sterile sheath

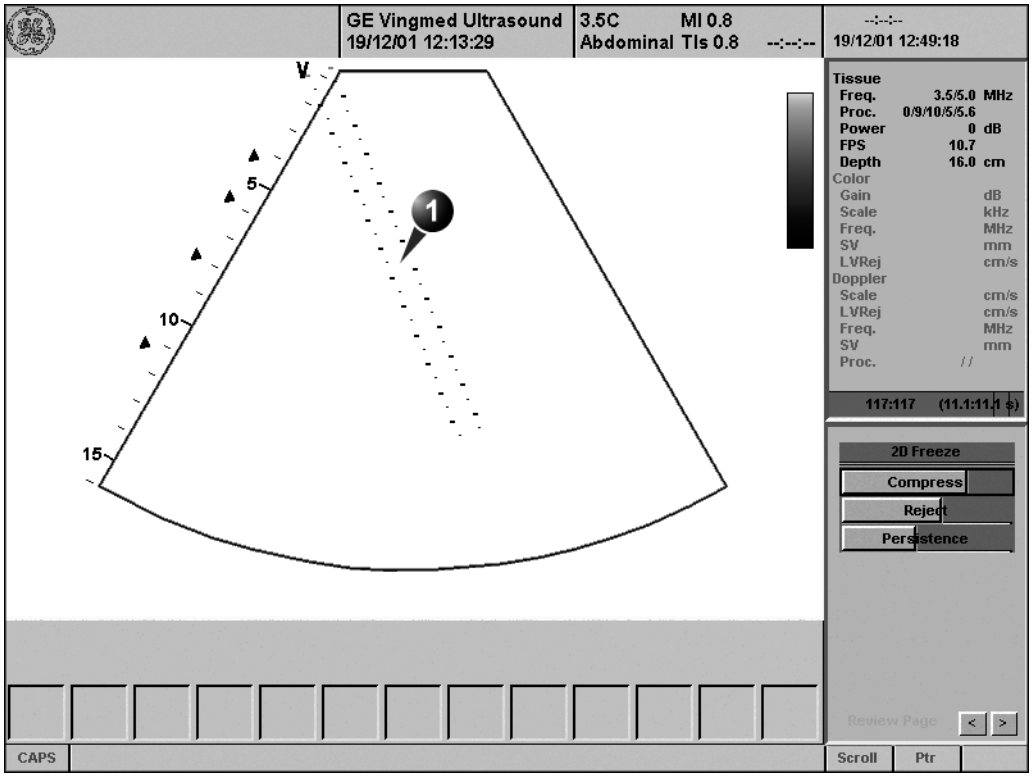
Refer to the Ultra-Pro II™ Needle Guide user manual.

Attaching the needle guide to the bracket

Refer to the Ultra-Pro II™ Needle Guide user manual.

Displaying the Guide zone

1. Select the desired probe with biopsy support.
2. Press F5 (Biopsy) on the alphanumeric keyboard. The biopsy guide zone is displayed on the screen.



1. **Biopsy guide zone**
   - **5 cm between the red marks**
   - **1 cm between the large yellow marks**
   - **0.5 cm between two consecutive marks**

   The first red mark is at 5 cm from the top of the needle guide.

Figure 10-8: Biopsy guide zone (Convex probe)

Biopsy needle path verification

Perform the Needle path verification once a year or whenever there is a suspicion of malfunction.

To verify that the path of the needle is accurately indicated within the guide zone on the system monitor, perform the following:

1. Properly install the bracket and biopsy guide (see page 377).
2. Scan in a container filled with a glycerol solution (6% in water).
3. Display the biopsy guide zone on the monitor (see page 379).
4. Ensure that the needle echo falls within the guide zone markers.

Starting the biopsy procedure

1. Press **F5**.
2. Place sterile coupling gel on the scanning surface of the probe/sheath.
3. Perform the biopsy.

Enabling color flow would allow for visualization of the vascular structure around the area to be biopsied.

Cleaning, disinfection and disposal

1. Refer to the Ultra-Pro II™ Needle Guide user manual for cleaning and disinfection of the bracket.
2. Perform cleaning and disinfection of the probe as described in page 370.
3. Dispose the sheath, bands and needle guide after use, according to medical regulations for biohazardious waste.

Chapter 11
Peripherals

This chapter includes the following information:

• Introduction 382
• VCR operation 384
• VCR Overview 384
• Using VCR 385
• Printing 388
• To print an image 388
• Specifications for peripherals 389

Introduction

This chapter provides information on peripherals that can operate with the Vivid 7/Vivid 7 PRO ultrasound unit, as follows:

- VCR
- Color Thermal Video Printer
- Black & White Thermal Video Printer

△
CAUTION

Use only GE Medical Systems approved internal equipment when replacing an internal peripheral.

External peripheral equipment must be CE marked and in compliance with related standards (EN 60601-1 or EN 60950). Conformance to EN 60601-1-1 (2000) must be verified.

All devices meeting IEC60950 must be kept outside of the patient environment, as defined in IEC60601-1-1 (2000), unless it, according to IEC60601-1-1 (2000), is equipped with additional protective earth or extra isolating transformer. Commercial devices such as laser cameras, printers, VCRs and external monitors, usually exceed allowable leakage current limits and, when plugged into separate AC outlets, are in violation of patient safety standards. Suitable electrical isolation of such external AC outlets, or providing the device with extra protective earth, will be required in order to meet UL2601-1 and IEC60601-1 standards for electrical leakage.

1. **Color Video Printer (side)**
2. **B&W Video Printer**
3. **VCR**

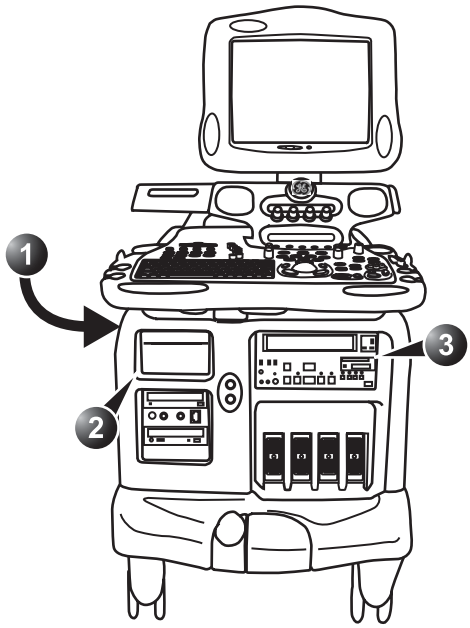


Figure 11-1: Peripheral locations on the Vivid 7/Vivid 7 PRO.

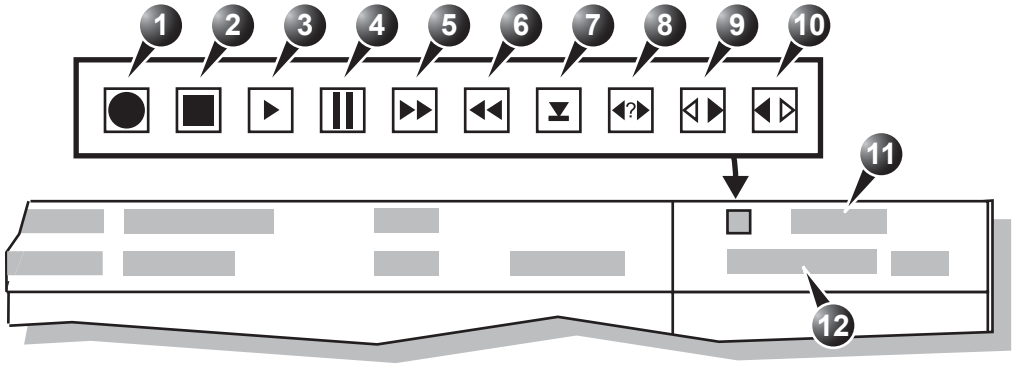
WARNING

When using peripheral device, observe all warnings and cautions given in peripheral operator manuals.

VCR operation

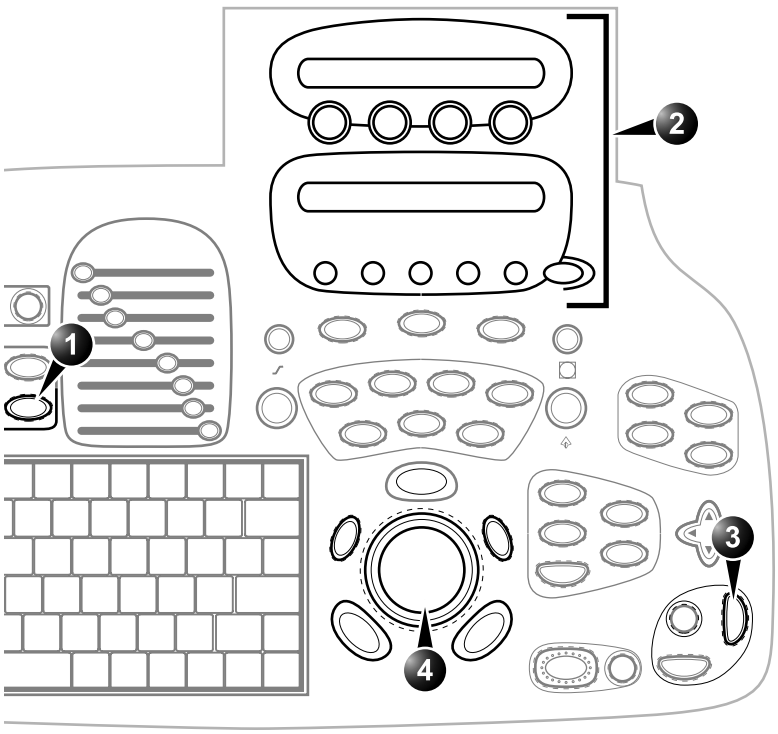
VCR Overview

The VCR is operated from the ultrasound unit control panel. The VCR status displayed on the screen indicates the current VCR function (see Figure 11-2).



1. **Recording (red)**
2. **Stop**
3. **Play**
4. **Pause (red while recording)**
5. **Fast Forward**
6. **Rewind**
7. **Eject**
8. **Search**
9. **Shuttle Forward**
10. **Shuttle Rewind**
11. **Date and time**
12. **Video counter**

Figure 11-2: The Video status area on the Title bar



1. **Video: enter video playback mode Displays the video assignable controls**
2. **Assignable keys:**
3. **Record/Pause**
4. **Shuttle speed**

Figure 11-3: The Video controls on the Control panel

Using VCR

Adjustment of the Video Counter

To start the video counter at a different point:

1. Press **VIDEO** on the Control Panel.
2. Press **MENU** in the Trackball area.
3. Trackball to **Video Counter/Search**.
4. Press **SELECT**.
   The *Video Counter/Search window* is displayed (Figure 11-5).
5. Use the **alphanumeric keyboard** to enter the counter number in the counter field.
6. Press **Set Counter** to save the change.

*Selecting **Cancel** will undo the current changes to the counter.*

7. Press **VIDEO** on the Control Panel to return to the scanning mode.

The ***Video Set Counter/ Search Window*** is also displayed when inserting the tape in the VHS.

Figure 11-4: The Video set counter / Search window

Start Recording

1. Press **REC/PAUSE** on the *Control panel*.
   A red dot is displayed in the *VCR status area* on the *Title bar* to indicate that recording has begun (see Figure 11-2).

Pause recording

1. Press **REC/PAUSE** on the *Control panel*.
   The video status icon is changed to (Pause).

Play back an examination

1. Press **VIDEO** on the Control Panel.
2. Use the **Assignable keys** on the *Control panel* to perform actions on the recorded session, such as stop, pause, rewind or fast forward (see Figure 11-3).
   The video status icon is updated accordingly (see Figure 11-2).

Searching in the video tape

1. Press **VIDEO** on the Control Panel.
2. Press **MENU** in the Trackball area.
3. Trackball to **Video Counter/Search**.
4. Press **SELECT**.
   The *Video Counter/Search window* is displayed (Figure 11-4).
5. Enter the counter value.
6. Trackball to **Search**.

7. Press **SELECT**.
   The VCR spools the tape and stops at the given counter value.

Additional playback features

When playing back an examination, part of it can be stored on the computer's memory as a cineloop. The cineloop enables the user to perform further operations on the stored section (see page 62 for further information on cineloop operation).

To store a recorded sequence as a cineloop

1. Press **FREEZE** while playing back a recorded session.
   The last few seconds are stored as a cineloop.

Refer to 'Cineloop operation' on page 62 for further details on working with cineloops.

Printing

The Vivid 7/Vivid 7 PRO ultrasound unit can support a color and a black & white thermal video printer. The printer devices are controlled from the **PRINT** keys on the control panel (see Figure 11-5).

The **PRINT** keys can also be configured to perform alternative storage (i.e. storage to DICOM media or secondary capture). See page 432 for configuration of the **PRINT** keys.

1. **Alt. Print**
2. **Print**

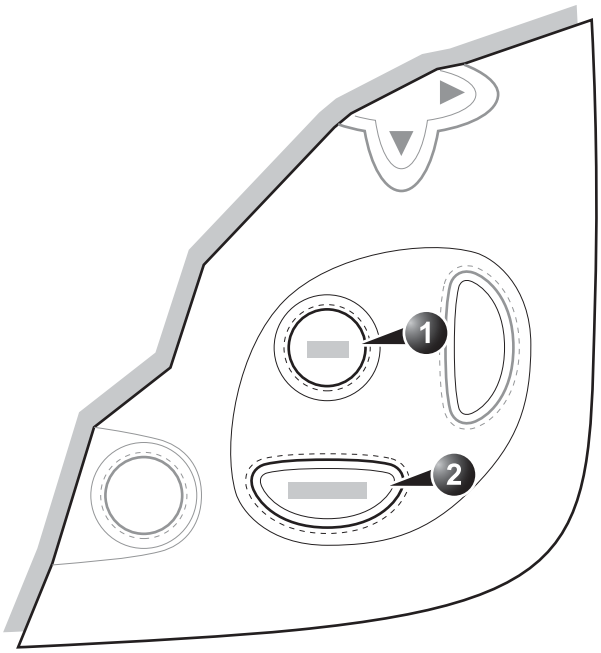


Figure 11-5: The printer The printer controls on the Control panel

To print an image

For details on the Thermal video printers operation, consult the manufacturer operator manual provided with the printer.

1. Press **PRINT** or **ALT.** on the Control panel (see Figure 11-5). The image displayed on the screen is printed on B&W or Color printer, depending on the key assignment configuration (see page 432).

Specifications for peripherals

Please refer to the documentation accompanying the peripherals.

Chapter 12
Presets and System setup

This chapter includes the following information:

• Introduction 392
• Starting the Configuration package 395
• To open the Configuration package 395
• Overview 396
• Imaging 397
• The Global setup sheet 397
• Application 400
• Application menu 404
• Measure 406
• Configuration of the Measurement menu 409
• Report 414
• The Report templates sheet 415
• The diagnostic codes sheet 418
• The Comment texts sheet 420
• Connectivity 423
• Dataflow 424
• Additional outputs 432
• Formats 437
• TCP/IP 442
• System 443
• The system settings 443
• About 447
• Administration 448
• Users 449
• Logon 452

Introduction

This chapter describes the configuration management package of the Vivid 7/Vivid 7 PRO ultrasound unit. The Vivid 7/ Vivid 7 PRO configuration package enables users to customize the global configuration for the unit and the application-specific settings.

In addition, users with administration rights have access to the local archive backup function, local archive restore function and creation of users.

The configuration management package consists of a *Setup dialogue window* divided in different setup categories with sublevels.

The table below summarizes the contents and access rights of the different categories and sublevels of the Vivid 7/ Vivid 7 PRO configuration package:

Category and sublevel	Description	access	Refer to
Imaging			page 397
• Global	Sets the cineloop controls and display. Sets the patient information display. Sets the scan information displayed on the video record.	All	
• Application	Configures the probe and application specific settings.	All	
• Application menu	Configures the *Application menu*.	All	
Measure	Configures the *Measurement menu* by selecting and defining the sequence of the measurements and calculation to perform. The selected measurements and calculation are displayed in the worksheet.	All	page 406
Report			page 414

Category and sublevel	Description	access	Refer to
• Templates	• Configures the *Report templates menu* by selecting and ordering the templates to show in the menu.	All	
• Diagnostic codes	Create or delete pre-defined text input for the referral reasons and diagnosis.	All	
• Comment texts	Create or delete pre-defined text input for the comments.	All	
Connectivity			page 423
• Dataflow	Create new dataflows or configure existing dataflows.	Admin	
• Additional outputs	Configure the **PRINT** and **ALT** keys.	Admin	
• Tools	Formats and verifies removable media.	All	
• Formats	Configures the *Examination list window display* and other options related to the patient management.	All	
• TCPIP	Sets the Transmission Protocol/ Internet Protocol.	Admin	
System			page 443
• Settings	Sets the date and time format, language and units.	Admin	
• Test	Enables testing of the different parts of the unit.	Admin	
About	Displays information about the software, hardware and probes.	All	page 447
Administration			page 448
• Backup	Local archive and system configuration backup.	Admin	

Category and sublevel	Description	access	Refer to
• Restore	Restore local archive and system configuration from a backup.	Admin	
• Users	Operator and referring staff registration, operator's rights settings.	Admin	
Service	This sheet is for service staff only. Deals with video selection, LCD light setting, printer definition and keyboard configuration.	Admin	

Starting the Configuration package

To access the Configuration package the user has to log on as a specific user (see page 449). This ensures user-specific and user-defined settings and presets to be used.

The access to the entire configuration package is user configuration dependent (see page 449).

To open the Configuration package

1. Press **CONFIG** on the alphanumeric keyboard.
   The *Log In window* is displayed asking for operator ID and password (see Figure 12-1).
2. Select **Log on** when completed.
   The *Setup dialogue window* is displayed (see Figure 12-2).

1. **Select the operator**
2. **Type password**

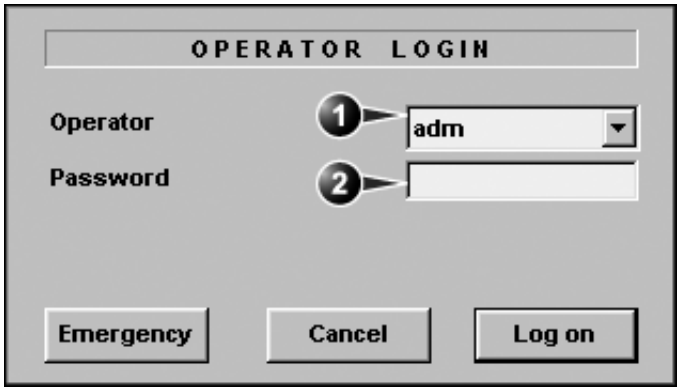


Figure 12-1: The Operator login window

Overview

The configuration management package consists of a *Setup dialogue window* divided in different setup categories with sublevels (sheets labelled with tab).

The functionality of each configuration category and associated sublevels are described on the following pages.

1. **Sublevel tabs for the selected Setup category.**
2. **Setup categories**
3. **Selected Setup category**

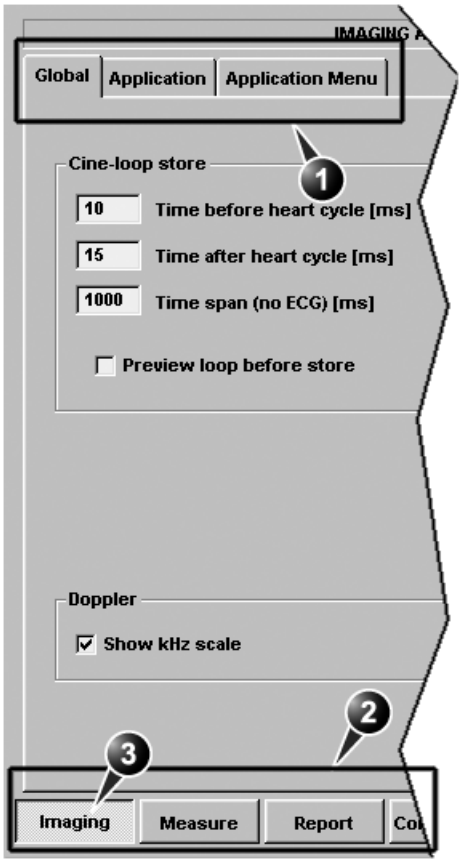


Figure 12-2: The Setup dialogue window structure

Imaging

- **Global**: enables the user to configure display-related settings.
- **Application**: enables configuration of the probe and application specific settings.
- **Application menu**: enables configuration of the Measurement menu.

The Global setup sheet

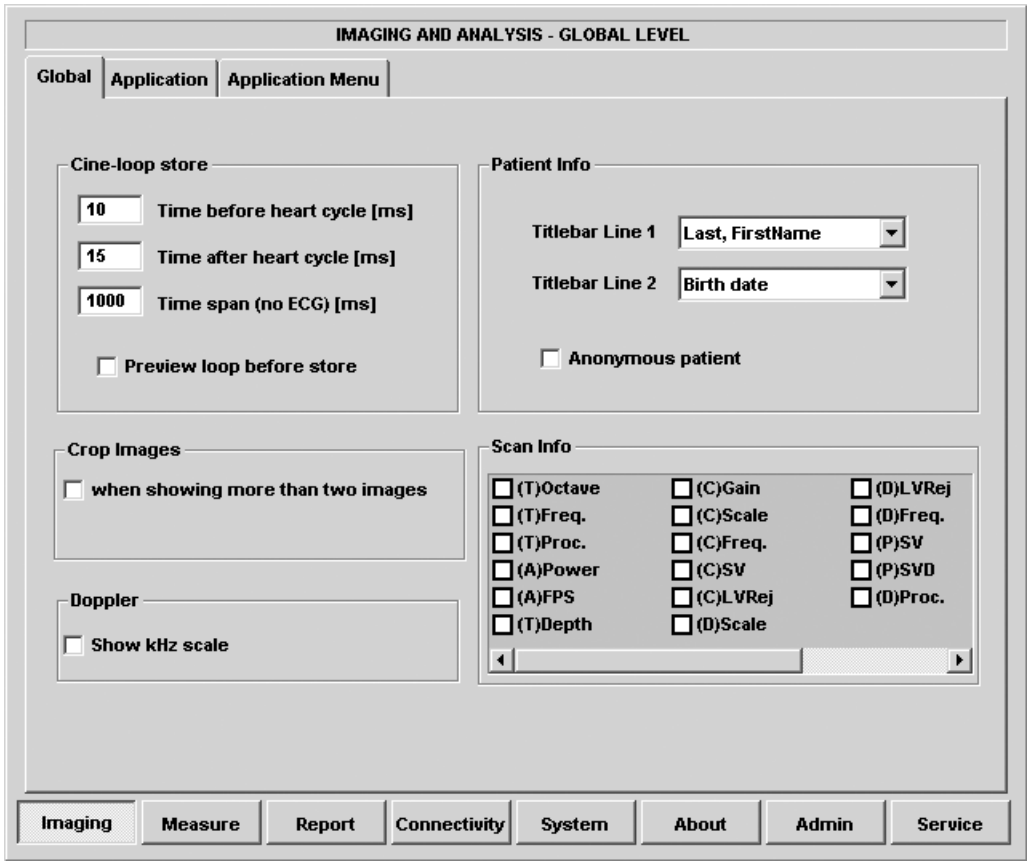
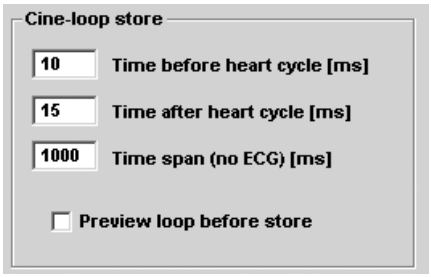
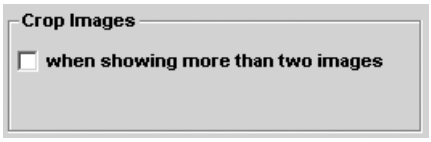


Figure 12-3: The Global setup sheet

Cineloop store

Parameter	Description
	**Cineloop store:** • **Time before/after heart cycle**: sets the total storage time span of the cineloop in ECG mode. • **Time span (no ECG)**: sets the total storage time span of the cineloop with no ECG. • **Preview loop before store**: when selected enable review of cineloops before storage.

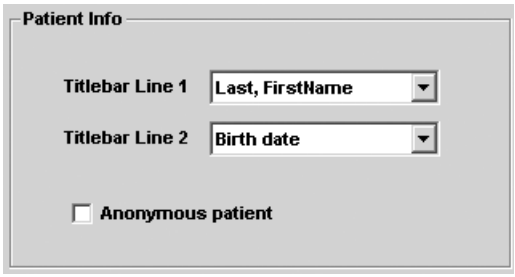
Crop images

Parameter	Description
	**Crop images:** ☑: In the *Analysis screen*, removes top and bottom of the image when more than two images have been selected.

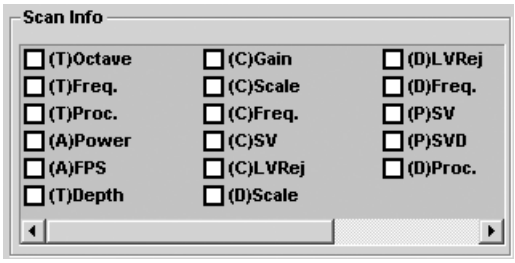
Doppler

Parameter	Description
	Doppler: • **Show KHz scale**: when selected, displays the KHz scale on the left side of the Doppler spectrum (see page 112).

Patient Info

Parameter	Description
	**Patient Info:** • **Title bar Line 1 & 2**: selects from the pop-up menu the patient information to display on the scanning screen's *Title bar* (see page 52). • **Anonymous patient**: when checked, no patient information is displayed on the scanning screen's *Title bar*.

Scan Info

Parameter	Description
	**Scan Info:** • ☑: displays scan information on the video record.

Application

The Application category enables the configuration of probe/ application specific settings (presets). The application-specific settings can be stored and used as default presets with this probe.

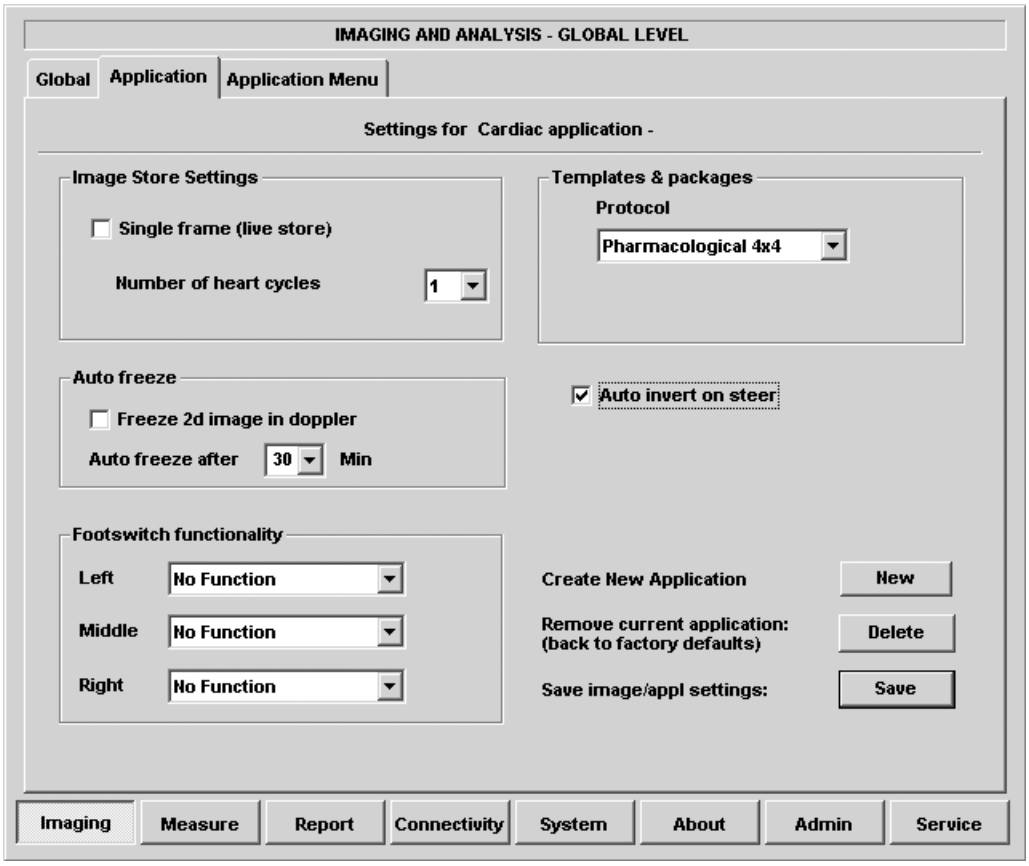
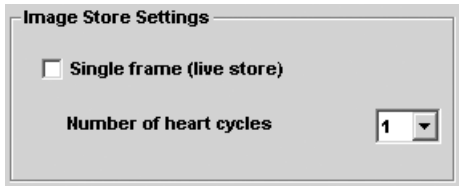
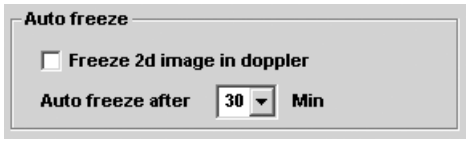
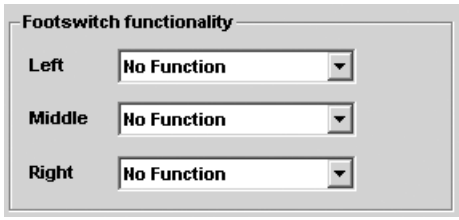
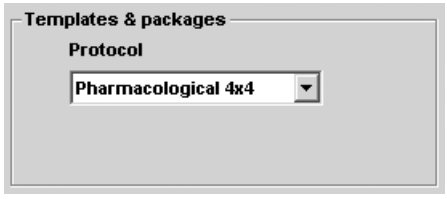
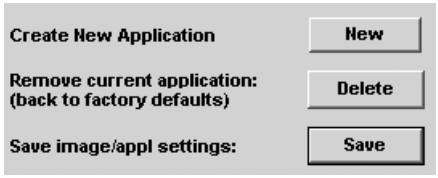


Figure 12-4: The Application setup sheet (example)

The Probe/application configuration parameters

Parameter	Description
	**Image Store settings:** • Single frame (live store): ☐: Store cineloop. ☑: Store single frame image only. • Number of heart cycles: Select the number of heart cycles to store (Single frame must be unchecked).
	**Auto freeze:** • **Freeze 2D image in Doppler**: the last 2D or color flow image is displayed when entering in Doppler mode. • **Auto freeze after**: sets the time after which the system enters in freeze when not in use.
	**Footswitch functionality:** Configures the footswitch pedal for the selected application. Select the operation to perform for each pedal from the associated *Pedal pop-up menu*.
	**Templates and Packages:** Defines the default stress protocol associated to the application. Select the default Protocol to be associated to the selected application from the *pop-up menu*.
	Auto invert on steer: In Color flow, the color bar is inverted when steering the color flow sector angle.

Parameter	Description
	**Create new application:** Press **New** to create a new Application. A dialogue window is displayed where the operator is asked to give a name to the new application. **Remove current application:** Press **Delete** to remove the current application. Factory Application settings cannot be deleted. **Save image/appl. settings** Press **Save** to store the changes applied to the current setting. Not applicable on factory application settings.

Create a new Application

The application created is probe dependant. Select the desired probe before configuring a new application.

1. Press **APPLICATION** on the Control panel.
2. Trackball to **Preset...** in the *Application pop-up menu*.
   The *Application setup sheet* (see Figure 12-4) is displayed.
3. **Adjust** the parameters as desired (see page 401).
4. Press **New**.
   A *Dialogue window* is displayed.
5. **Enter** a name for the new application.
6. Press **OK**

To edit an application

1. Press **APPLICATION** and select the application to edit.
2. Press **APPLICATION** again.
3. Trackball to **Preset...** in the *Application pop-up menu*.
   The *Application setup sheet* (see Figure 12-4) is displayed.
4. Change the parameters as desired (see page 401).
5. Press **Save** to store the changes.
   Applicable only on user-defined applications.

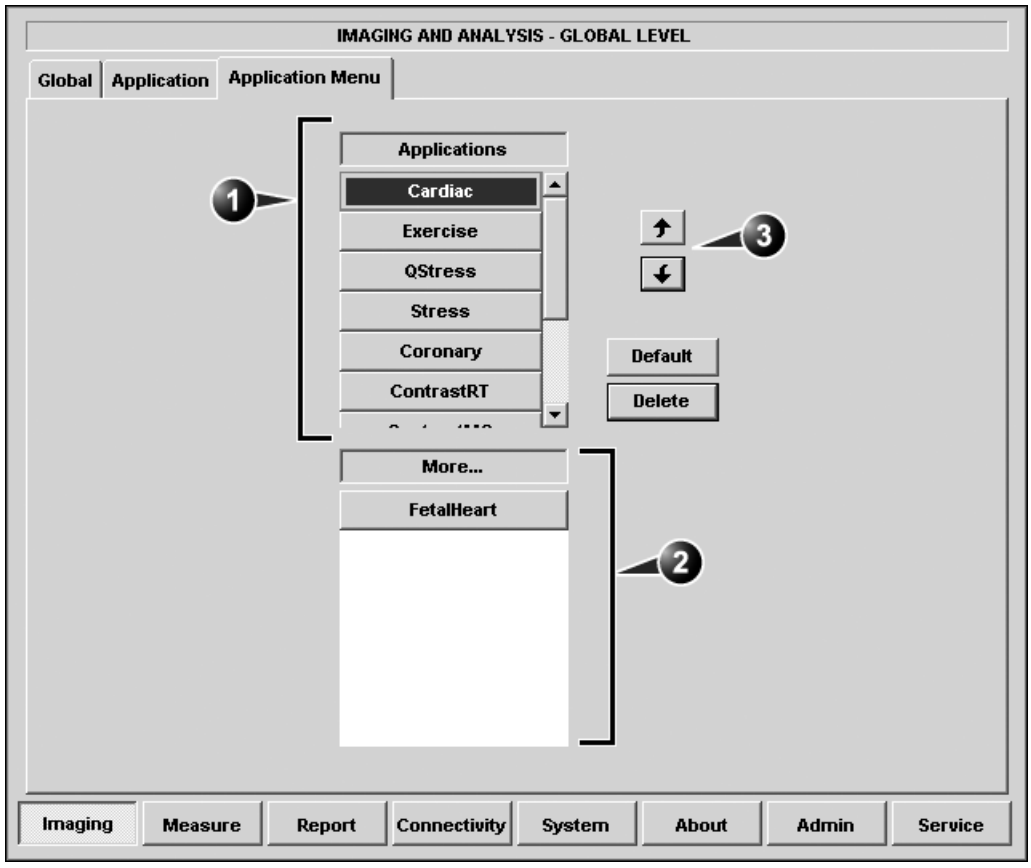
Deletion of an Application

1. Press **APPLICATION** and select the application to delete.
2. Press **APPLICATION** again.
3. Trackball to **Preset...** in the *Application pop-up menu*.
   The *Application setup sheet* (see Figure 12-4) is displayed.
4. Press **Delete** to remove the selected application.

Application menu

The Application menu category enables rearrangement of the the *Application menu* to best suit the user's requirements.

The Application menu is a two-levels pop-up menu. The first level called **Application**, displays the most frequently used applications in any desired order. The second level called **More...** displays the less frequently used applications.



1. **First menu level**
2. **Second menu level**
3. **Moving tools**

Figure 12-5: The Application menu setup sheet (example)

Configuration of the Application menu

The Application menu can be configured by moving the applications up and down inside the pop-up menu and from one level to the other.

To move an application inside one level

1. Trackball to the application to move.
2. Press **SELECT**.
3. Press [↑].
   The application is moved one step up.
4. Press [↓].
   The application is moved one step down.

*Press **Default** to get factory setting.*

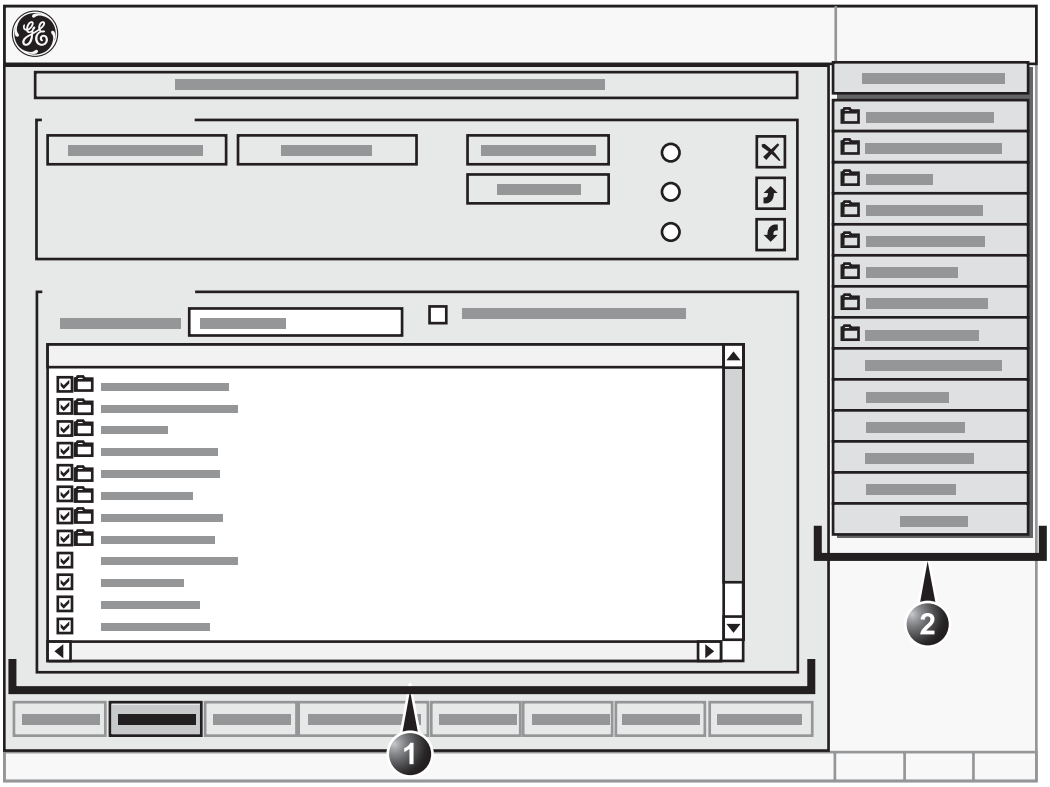
To move an application from one level to the other

1. Trackball to the application to move.
2. Press **SELECT**.
3. Press as many times as necessary:
   - [↑] if the application to move is in the *More menu*
   - [↓] if the application to move is in the *Applications menu*

   till the application has moved to the other menu.

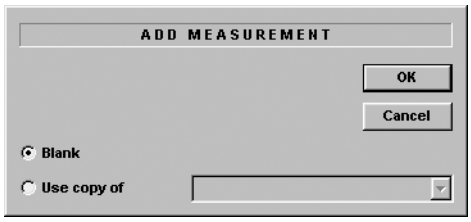
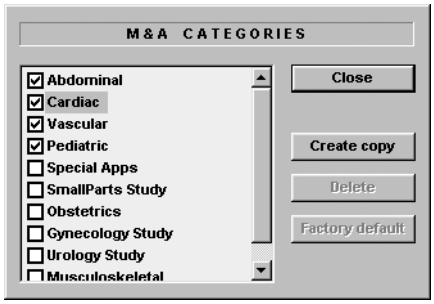
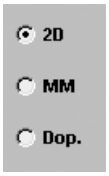
Measure

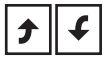
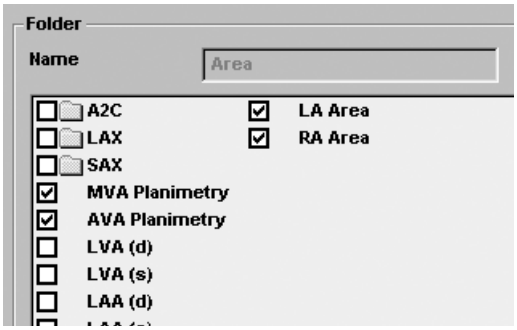
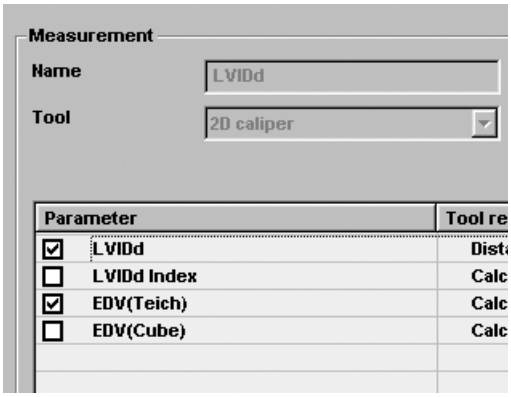
The Measure setup category enables the organization of the Factory default *Measurement menu* or the creation of user-defined *Measurement menus* to best suit the user's requirements.



1. **Configuration window (see next pages for details)**
2. **The measurement menu (displays updated configuration)**

Figure 12-6: The Measurement menu setup sheet

Parameter	Description
	**Add measure:** Create or select from the pop-up list a measurement to be added to a folder.
	Add folder: Enables the user to create its own folder with the desired measurements. The folder is displayed the *Measurement menu*.
	**M&A Categories:** Enables selection of the measurement categories to display in the Measurement menu. Only checked items will be displayed. • **Create Copy**: Enables copy of a selected measurement category (selection is done by selecting the category name). • **Delete**: enables deletion of user-defined measurement categories. • **Factory Default**: restores factory display.
	**2D, MM and Dop. radio buttons:** Enables the display of mode related *Measurement menu* in the configuration window.

Parameter	Description
	Configuration tools: **Deletes** selected entry (folder or measurement) in the *Measurement menu*. The factory entries cannot be deleted.  **Moves** selected measurement or folder up or down inside the *Measurement menu*.
	**Folder:** Displayed when a folder is selected in the *Measurement Menu*. Shows the entire contents of a selected folder. • ☑: the items is displayed in the *Measurement menu*. • ☐: The item is hidden from the *Measurement menu*.
	**Measurement:** Displayed when a measurement is selected in the *Measurement Menu*. Shows all the parameters related to the selected measurement. • ☑: the items is displayed in the *Measurement menu*. • ☐: The item is hidden from the *Measurement menu*. Only checked parameters will be displayed in the *Measurement result window*, the worksheet and the report.
	Auto sequence: ☑Prompts the next measurement in the folder.

Configuration of the Measurement menu

Display of the Measurement categories

1. Press **M&A categories** in the *Configuration window*.
   The M&A categories are displayed in a pop-up window (see page 407).
2. Check the categories to be displayed.
   Uncheck the categories to hide.

To copy a Measurement category

1. Press **M&A categories** in the *Configuration window*.
   The M&A categories are displayed in a pop-up window (see page 407).
2. Move the trackball marker over the M&A category name.
3. Press **SELECT** to highlight the category.
4. Press **Create copy**.
   A copy of the selected measurement category is displayed in the *Measurement menu*.

Factory Measurement categories cannot be renamed.

To rename the Measurement category:

1. Select the Measurement category in the *Measurement menu*.
2. **Enter** a new name in the Measurement field.

Selection of a Measurement category

1. Trackball to the Measurement menu heading.
2. Press **SELECT**.
   The measurement categories are displayed in a sub-menu.
3. Trackball to the measurement category of interest.
4. Press **SELECT**.
   The measurement category is displayed.

Moving an item in the Measurement menu

1. Trackball to the entry to move into the *Measurement menu*.
2. Press **SELECT**.
3. Press or to move the selection up or down inside the *Measurement menu*.

Deleting an item in the Measurement menu

Only user created items can be deleted.

1. Trackball to the entry to delete in the *Measurement menu*.
2. Press **SELECT**.
3. Press [X] to delete the item.

Display/hide a folder or a measurement in the Measurement menu

The Measurement menu (Folders and Measurements) can be configured to display only the entries (folders and measurements) of interest.

To hide a folder or a measurement:

1. **Uncheck** the actual folder or measurement in the *Folder* or *Measurement field* in the *Configuration window*.

To display a hidden folder or measurement:

1. **Check** the actual folder or measurement in the *Folder* or *Measurement field* in the *Configuration window*.

Creating a user-defined folder

1. If the folder is to be inside another folder, select the actual folder in the *Measurement menu*.
2. Press **Add folder**.
   The *Measurement menu* is updated.
3. Select the new folder and **Enter** the folder name in the *Name text field*.

Adding a measurement to a folder

The user can either add a pre-defined measurement or create a new measurement with user-defined parameters to a folder.

1. Select the folder in the *Measurement menu*.
2. Press **Add Measure**.
   The Add measurement dialogue window is displayed (Figure 12-7).

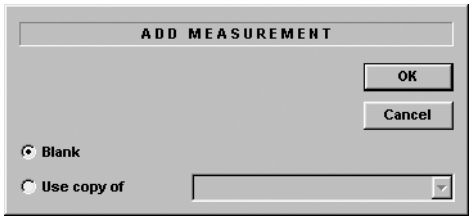


Figure 12-7: The Add Measurement dialogue window

To add an existing measurement with pre-defined parameters

1. Select **Use Copy of**.
2. Select the measurement in the pop-up menu.
3. Press **OK**.

To create a measurement with user-defined parameters

1. In the *Add measurement dialogue window*, select **Blank**.
2. Press **OK**.
3. In the *Measurement field*, **enter** the measurement name.
4. Select the desired measurement type in the *Tool pop-up menu*.
   The actual measurement parameters are displayed.
5. Trackball to the first parameter in the *Parameter column*.
6. Press **SELECT** twice to activate the free text cursor.
7. **Enter** a name for the parameter.

Adding a user-defined function to a measurement

1. Select the actual measurement in the *Measurement menu*.
   The parameters related to the measurement are listed in *Parameter list*.
2. **Press twice** on an empty line at the bottom of the *Parameter list*.
   The free text cursor is activated.
3. **Enter** a name for the parameter.
4. Press on the **Parameter line** once again.
   The *Edit Formula dialogue window* is displayed.

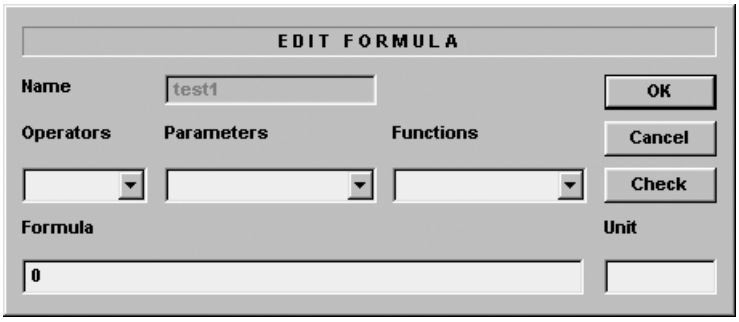


Figure 12-8: The Edit formula dialogue window

5. Create a formula by selecting parameters, operators and functions.
   Unit: All results are calculated in SI units. If the unit is not specified or not one in the table below, the displayed value will be in SI units. All conversions to other units must include a conversion factor in the formula. If the unit is one in the table below, the conversion factor will be included in the formula.

△
CAUTION

Make sure that the formula gives a SI unit that is compatible with the conversion unit.

6. Press **Check** to control the formula.
7. Press **OK** to store the parameter.

△
CAUTION

GE Ultrasound do not take any responsibility for the correctness of the user-defined functions.

Calculation	SI	Alternative unit
Time	s	ms - msec - min - h
Ratio	%	
Frequency	bpm	
Angle	rad	deg - grad
Distance	m	cm - dm - cm - mm - inch - feet- pixels

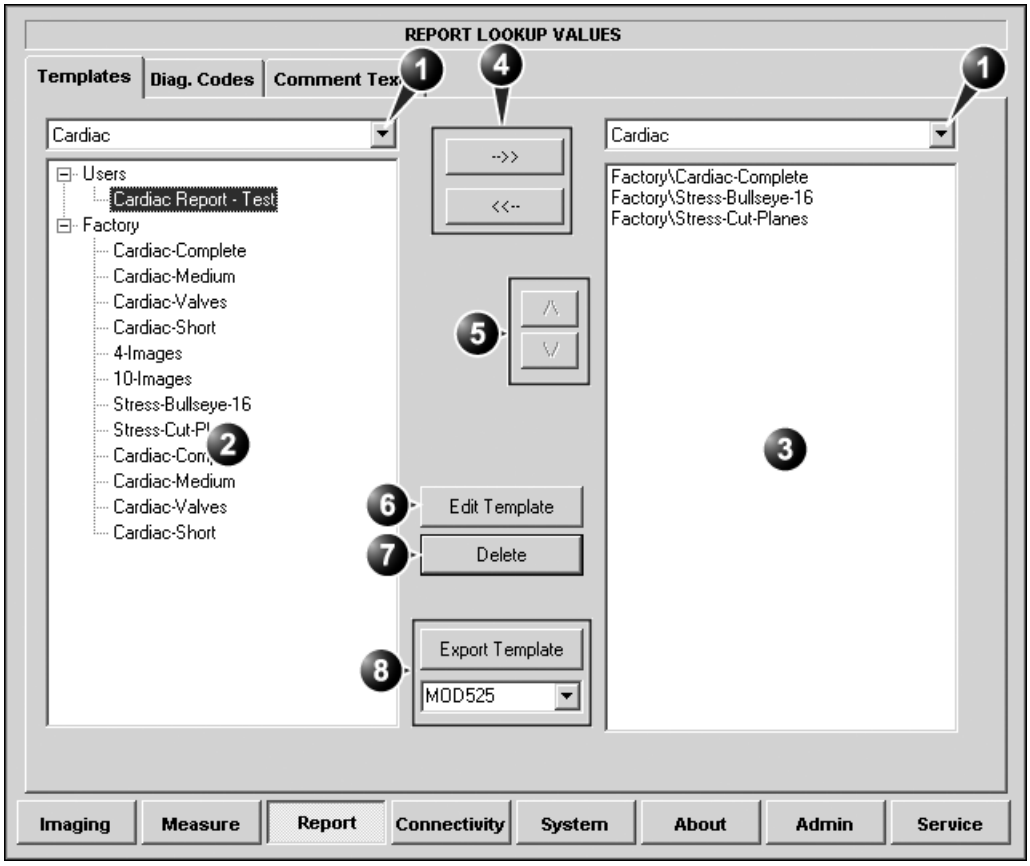
Calculation	SI	Alternative unit
Velocity	m/s	dm/s - cm/s - mm/s - inch/s
Acceleration	m/s^2	dm/s2 - cm/s2 - mm/s2 - inch/s2
Area	m^2	dm2 - cm2 - cm^2 - mm2 - inch2
Volume	m^3	dm3 - cm3 - l - dl - cl - ml - gallon - quart
Volume flow	m^3/s	dm3/s - cm3/s - l/s dl/s - cl/s - ml/s - m3/min dm3/min - cm3/min - l/min - L/min - dl/min cl/min - ml/min - ml/m2
Pressure	mmHg	Pa - kPa - bar - torr - atm - psi
Pressure/time	mmHg/s	mmHg/s
Mass	kg	g - ounce - pound
Other		mmHG - Date - WeekDay - Day - NoUnit l/minm2 - g/m2 - cm/m2

Report

The *Report configuration category* is divided in three sheets:

- **Templates**: enables the configuration of the *Template selection menu*
- **Diagnostic codes**: enables the creation of pre-defined text inputs to be used in the *Diagnosis information field* in the *Examination list window* (see Figure 8-10, page 286).
- **Comment texts**: enables the creation of pre-defines text inputs to be used in the *Comment information field* in the *Examination list window* (see Figure 8-10, page 286).

The Report templates sheet



1. **Application selection pop-up menu**
2. **List of factory and user-defined report templates for the selected application**
3. **List of report templates shown in the *Template selection menu* for the selected application**
4. **Add/remove selected template to/from the *Template selection menu*.**
5. **Move selected template up/down in the *Template selection menu*.**
6. **Open selected template in the template designer.**
7. **Delete selected template (user-defined templates only)**
8. **Export template to MOD or CD-R**

Figure 12-9: The Report templates sheet

Configuration of the Template selection menu

The configuration of the Template selection menu is done by:

- Selecting the application specific *Template list* (left field) and the application specific *Template selection menu* (right field).
- Inserting or removing report templates to/from the *Template selection menu*.
- Sorting the report templates in the *Template selection menu*.

Procedure

Selecting the application specific template list and Template selection menu:

1. Trackball to the *Application selection pop-up menu* over the list of report templates (left field, see Figure 12-9).
2. Press **SELECT**.
   The pop-up menu is displayed.
3. Trackball to the desired application.
4. Press **SELECT**.
   The list of factory and user-defined report templates (left field, see Figure 12-9) is updated showing the available templates for the selected application.
5. Likewise select the application for the *Template selection menu* (right field, see Figure 12-9).

Inserting a template to the Template selection menu

1. Trackball to the template to insert in the *Template list* (left field).
2. Press **SELECT**.
3. Press the **Right arrow button** [->>].
   The selected template is inserted in the *Template selection menu* (right field).

Removing a template from the Template selection menu

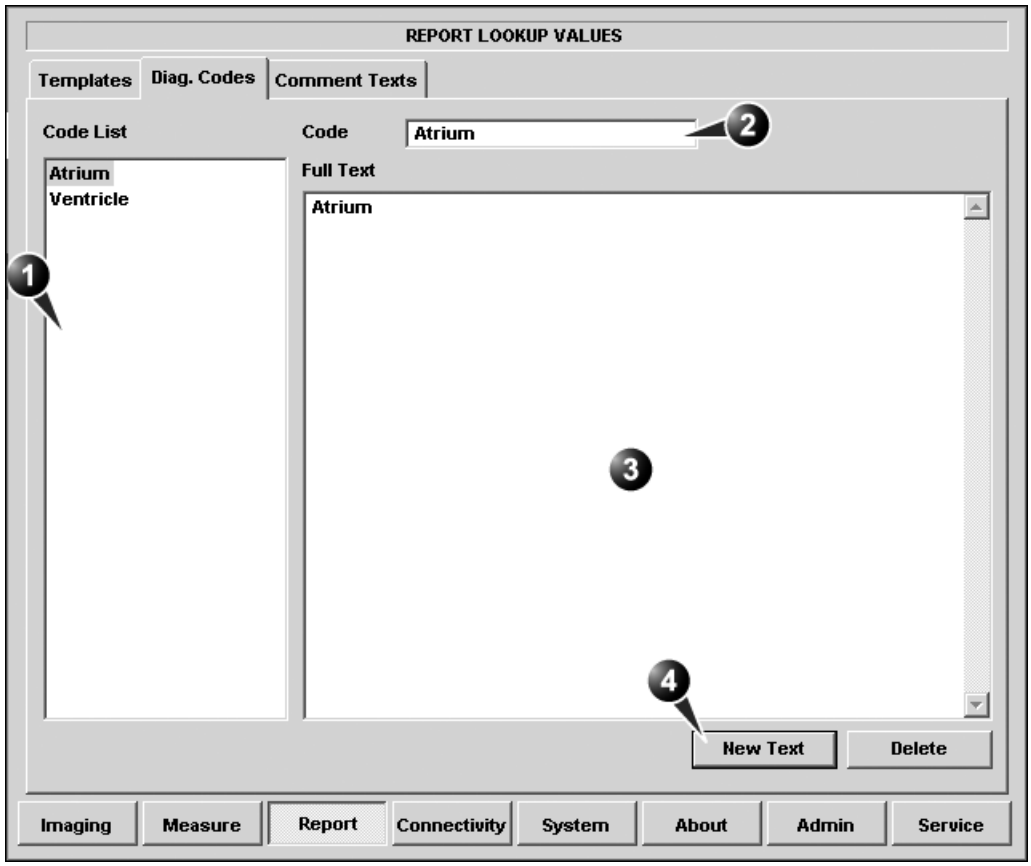
1. Trackball to the template to remove in the *Template selection menu* (right field).
2. Press **SELECT**.
3. Press the **Left arrow button** [<<-].
   The selected template is removed from the *Template selection menu* (right field).

Sorting the templates in the Template selection menu

1. Trackball to the template to move in the *Template selection menu* (right field).
2. Press **SELECT**.
3. Press the **Up** or **Down arrow buttons** [^] [v].
   The selected template is moved accordingly in the *Template selection menu*.

The diagnostic codes sheet

This sheet enables the creation (and deletion) of text inputs that can be used when entering diagnostic codes in the *Examination list window* (see Figure 8-10, page 286).



1. **List of text inputs**
2. **Text input name**
3. **Text input display area (free test area)**
4. **Create a text input**

Figure 12-10: The Diagnostic codes sheet

Creating a diagnostic codes

1. Select **New text** to create a new diagnostic code (see Figure 12-10).
2. In the *Code field* enter a name for the diagnostic code.

3. Trackball to the *Text input display area*.
4. Press **SELECT**.
5. Enter the text.
   The new text input is created and can be selected when entering diagnostic information in the *Examination list window* (see page 285 for more information about diagnostic codes).

Deleting a diagnostic code

1. In the *Code list field*, trackball to the diagnostic code to delete (see Figure 12-10).
2. Press **SELECT**.
3. Trackball to **Delete**.
4. Press **SELECT**.

The Comment texts sheet

This sheet enables the creation (and deletion) of text inputs that can be used when entering comments in the *Examination list window* (see Figure 8-10, page 286).

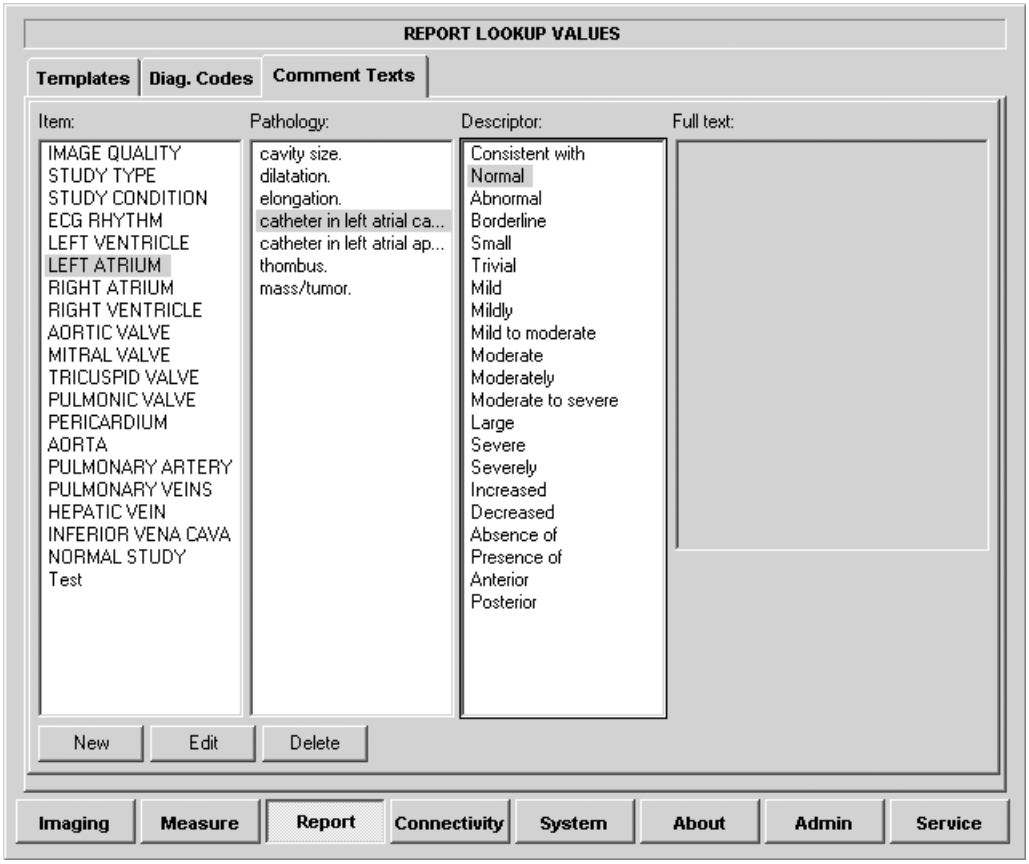


Figure 12-11: The Comment texts sheet

The pre-defined text list is organized in a three level hierarchy. Selecting one item in column one (**Item**) displays a specific pre-defined text list in column two (**Pathology**) related to the item selected. Likewise selecting a pathology term in column two displays a specific pre-defined text list in column three (**Descriptor**) related to the pathology selected.

Creating pre-defined text input

Creating a new Item (first level)

1. Select the first level.
2. Press **New**.
   The *Enter new text window* is displayed.

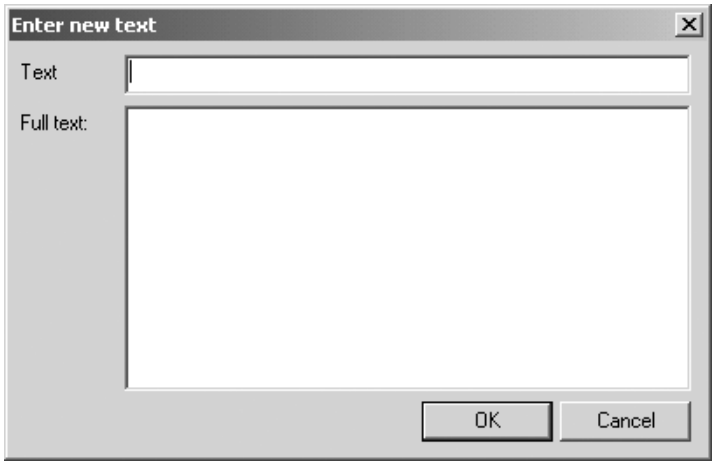


Figure 12-12: The Enter new text window

3. Enter a title for the item in the *Text field*.
   Enter the pre-defined text in the *Full text field*.
4. Press **OK**.

New Pathology text

1. Select the item in the first column.
2. Select the second column.
3. Press **New**.
   The *Enter new text window* is displayed (Figure 12-12).
4. Enter a title for the Pathology in the *Text field*.
   Enter the pre-defined text in the *Full text field*.
5. Press **OK**.

New Descriptor text

1. Select the item in the first column.
2. Select the Pathology term in the second column.
3. Select the third column.
4. Press **New**.

The *Enter new text window* is displayed (Figure 12-12).

5. Enter a title for the Descriptor in the *Text field*.
   Enter the pre-defined text in the *Full text field*.
6. Press **OK**.

Editing a pre-defined text input

1. Select the term to edit in one of the columns.
2. Press **Edit**.
3. The *Edit text window* is displayed.

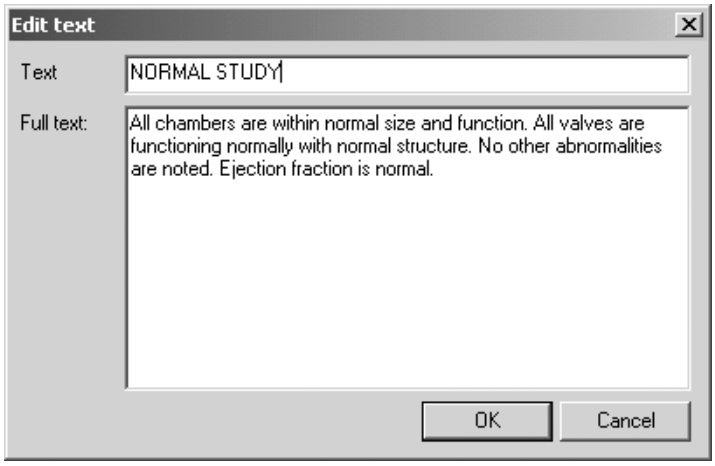

Edit text
Text
NORMAL STUDY
Full text:
All chambers are within normal size and function. All valves are functioning normally with normal structure. No other abnormalities are noted. Ejection fraction is normal.
OK
Cancel

Figure 12-13: The Edit text window

4. Edit the text in both the *Text* and *Full text fields*.
5. Press **OK**.

Deleting a pre-defined text input

1. Select the term to delete in one of the columns.
2. Press **Delete**.
3. A *Confirmation window* is displayed.
4. Press **Yes**.
   The selected text input is deleted including the belonging text inputs.

Connectivity

This configuration setup category deals with:

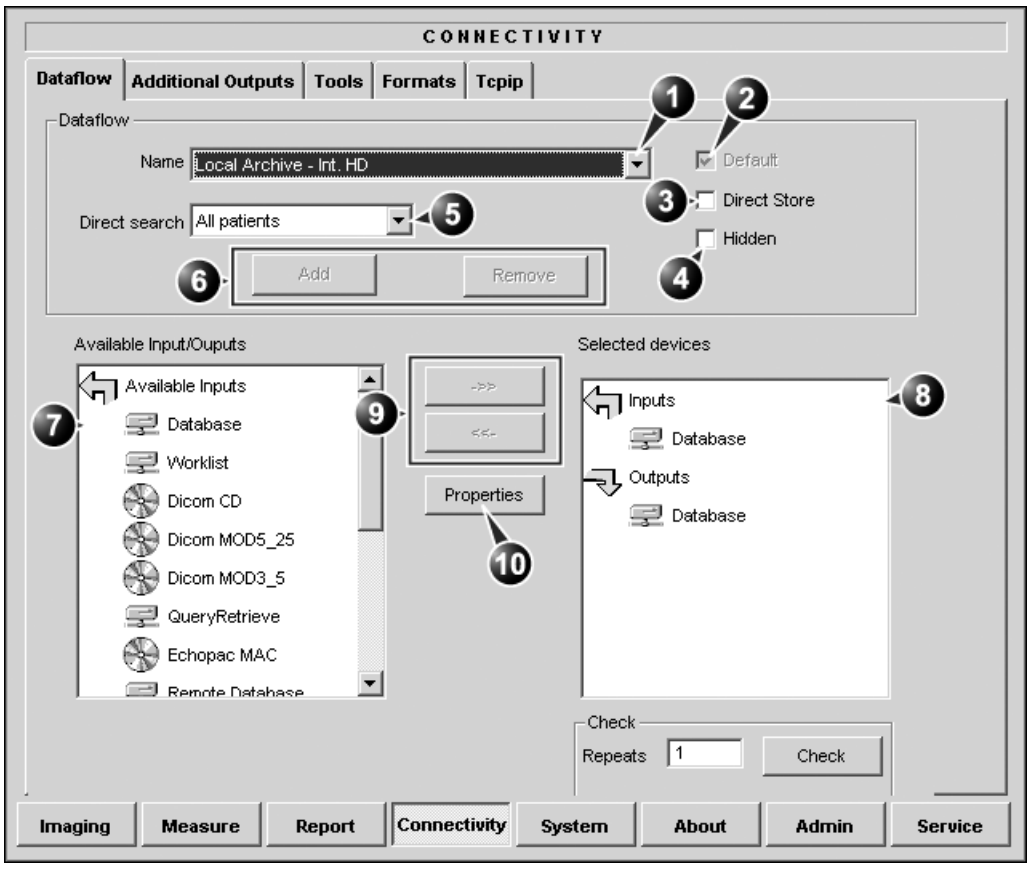
- **Dataflow**: connection and communication setup of the ultrasound unit with other devices.
- **Additional output**: configuration of the **PRINT** and **ALT** keys on the control panel.
- **Tools**: formatting of removable media
- **Formats**: configuration of the *Examination list window* and other tools related to patient management.
- **TCPIP**: internet protocol configuration

Dataflow

Communication between the Vivid 7/Vivid 7 PRO ultrasound unit and other information providers on the network takes the form of dataflows. Each dataflow defines the transfer of patient information and images from an input source to the unit, and from the unit to one or several output sources.

A dataflow is a set of pre-configured settings. Selecting a dataflow will automatically customize the unit to work according to the settings associated with this dataflow.

Dataflows are configured in the *Dataflow sublevel sheet* in the *Connectivity setup category* as described below. The *Dataflow sublevel sheet* is only available to users with administration rights.



1. **Select a dataflow to edit**
   Factory defined dataflows cannot be edited.
2. **Use selected dataflow as default**
3. **Store data directly to archive**
4. **Hide selected dataflow from the list of available dataflow**
5. **Option for the search function. In the Search/ Create patient window select between None, All patients and Today's patient**
6. **Add/Remove a user-defined dataflow**
7. **Available input/output devices that can be assigned to the current dataflow**
8. **Input/output devices assigned to the current dataflow**
9. **Add/remove selected device to/from the current dataflow (user-defined dataflows only)**
10. **Adjust the settings for the selected assigned device**

Figure 12-14: The sublevel Dataflow (example)

Dataflows available

A set of pre-defined dataflows is available on the unit as listed in the table below. Input/output devices cannot be added/

removed to/from the pre-defined dataflows. However the settings for the devices can be adjusted (see page 430).

	Dataflow	Description
	No Archive	Enables to perform an examination without storing the data to the archive.
	LocalArchive-Int.HD	**Local archive internal harddrive** The local database is used for patient archiving. Images are stored to internal harddrive.
	LocalArchive-MOD	**Local archive Magneto Optical Disk (MOD)** The local database is used for patient archiving. Images are stored to a MOD. The stored image files will consist of raw data only, together with a single-frame DICOM preview image (no DICOM multi-frame is stored).
	LocalArchive-Int.HD/MOD	**Local archive internal harddrive and Magneto Optical Disk** The local database is used for patient archiving. Images are stored to the internal harddrive and to a MOD as DICOM Media. The stored image files, both to internal harddrive and to the MOD, will consist of both DICOM (multi-frame if cineloop) and raw data.
	Local Archive - Int HD/ DICOM Server	The local archive is used for patient archiving. Images are stored to the internal hard drive and to a DICOM server.

	Dataflow	Description
	RemoteArch-RemoteHD	**Remote archive remote harddrive** A remote database (either on EchoPAC workstation or on EchoServer) is used for patient archiving. Images are stored to a network image volume (either internal HD on EchoPAC workstation or EchoServer volume).
	Remote Archive - Remote HD/DICOM Server	A remote database is used for patient archiving. Images are stored to a network image volume and to a DICOM server.
This dataflow cannot be used with an ImageVault 3.0 server.	**RemoteArchive-MOD**	Remote archive Magneto Optical Disk A remote database (either on EchoPAC workstation or on EchoServer) is used for patient archiving. Images are stored to a MOD.
WL-LA-DServ: the local database is not searched, only the DICOM Modality Worklist.	**Worklist/LocalArchive-DICOMServer/Int.HD**	**Modality Worklist local archive DICOM server and local harddrive** Search in the DICOM Modality Worklist, the patient found is copied into local database. The patient information and the examination results are stored to the local the database. Images are stored to a DICOM Server and to an image volume on the local harddrive.
	Worklist/RemoteArchive-DICOMServer/RemoteHD	Modality Worklist remote archive DICOM server and remote harddrive Search in the DICOM Modality Worklist, the patient found is copied into a remote database. The patient information and examination results are stored to a remote database. Images are stored to a DICOM Server and to an image network volume as pure DICOM in both locations.

	Dataflow	Description
	Worklist/Remote Archive - Remote Storage	This dataflow is used in a network environment that includes Vivid HL7 Gateway. The patient list in the *Search/Create Patient window* is coming from Vivid HL7 Gateway through DICOM Modality Worklist. All patient data and images are stored to EchoServer.
	Raw DICOM MOD	Raw image format to/from a DICOM Magneto Optical Disk Read/Write images in raw format from/to a DICOM formatted 5.25" MO-disk.
	DICOM MOD	Pure DICOM image format to/from a DICOM Magneto Optical Disk Read/Write images in “pure” DICOM format from/to a DICOM formatted 5.25" MO-disk.
	DICOM CD read	DICOM CD read Read DICOM Media from the CD-drive.
EP MAC MOD: the MOD must be PC-formatted. Only images can be read.	**EchoPAC Mac MOD read**	EchoPAC Macintosh Magneto Optical Disk read Read MOD from EchoPAC (Macintosh).
	DICOM Server	DICOM server Store pure DICOM images to a DICOM device.
	DICOM Print	DICOM Print Send images to a DICOM printer.
	Query Retrieve	Query Retrieve Retrieve images from a DICOM server

To select the default dataflow

1. Select the dataflow in the *Name drop-down menu*. (see Figure 12-14).
2. **Check** the *Default box*.
   The dataflow will be selected by default when restarting the unit.
3. **Check** the *Direct Store box* to have data stored automatically to the archive (no buffer storage).

To create a new dataflow

1. Press **Add**.
   The *Add dataflow window* is displayed.

Figure 12-15: The Add dataflow window

2. Enter a name for the new dataflow.
3. Press **OK**.
4. Select an **Input device** in the *Available inputs/outputs field* and press the **Right arrow button** to assign the service to the dataflow.
5. Repeat step 4 to assign input/output devices as desired. Most dataflows consist of one input device and one or several output devices. However in two cases it is possible to have two input devices, when defining a dataflow with DICOM Worklist or DICOM Query/Retrieve in combination with a database.
6. Adjust the device's parameters as described below.
7. To remove a device from the dataflow, select the device in the *Selected devices field* and press the **Left arrow button**.

Adjusting the assigned devices

1. Select the device in the *Selected devices field*.
2. Press **Properties**.
   The *Properties window* is displayed.
3. Adjust the device specific parameters as desired (see table below). Not all the settings listed below apply to all devices.

General settings	Definition
Name	Free text: give a descriptive name for the device.
IP address	Select from drop-down menu
Database Name	Automatically selected according to the IP address
File destination	Automatically selected according to the IP address
Removable	Check the entry is the media is removable.

Image settings	Definition
Allow raw data	☑: save data in both raw and DICOM format. ☐: save data in DICOM format only.
Max Framerate	Select 25, 30 or Full from the pop-up menu. Full (original acquisition) is default.
Compression	Select compression type or no compression.
Quality	Set picture quality from 1 to 100%. A low picture quality level allows high data compression, while a high picture quality restrains the compression.
Allow Multiframe	☑: allow cineloop storage.

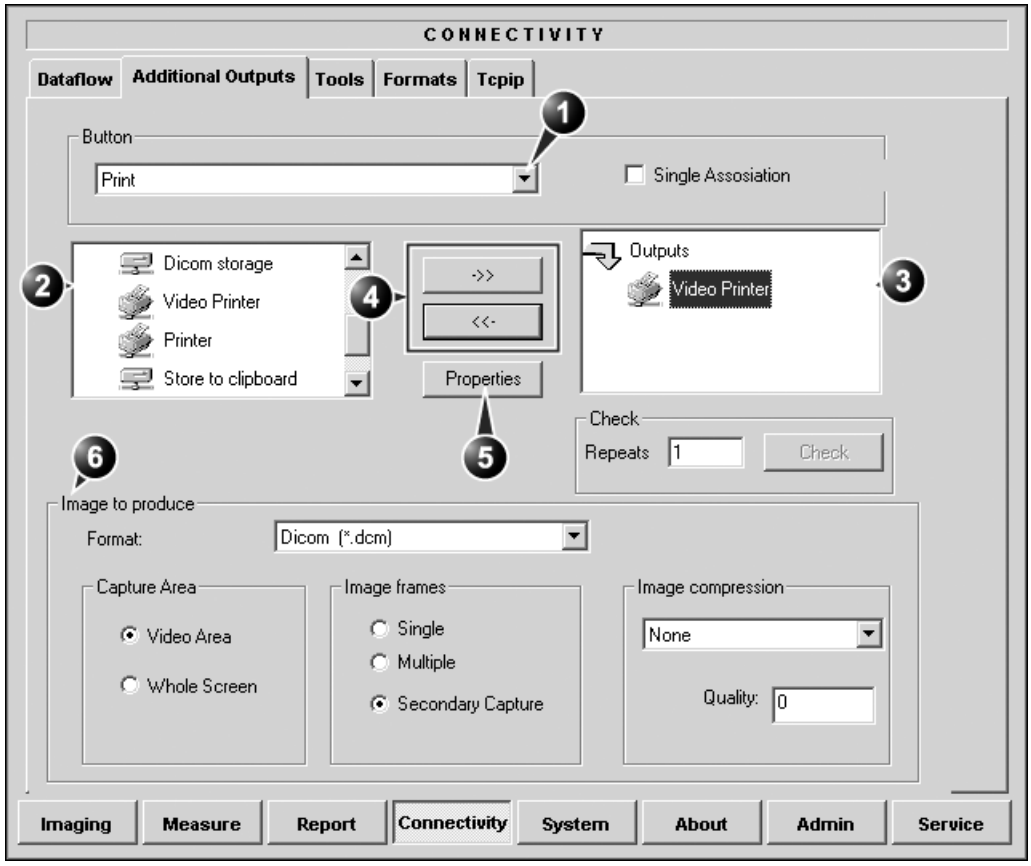
Connection settings	Definition
Retry	Set maximum number of connection tentatives, time interval between tentatives and time-out.

DICOM settings	Definition
AE Title	The Application Entity Title is set during DICOM configuration. Refer to the network specifications.

DICOM settings	Definition
Port	The Port no. is allocated during DICOM configuration. Refer to your network specifications.
Verification	Verify the connection to another DICOM application
Storage commitment	Send a request to a PACS, asking it to permanently archive image(s)
MPPS	Modality Perform Procedure Step: send information (typically to a HIS) that a scheduled exam has been started, performed or interrupted.

Additional outputs

The *Additional outputs sheet* deals with configuration of the **PRINT** and **ALT** keys on the control panel. Several outputs (e.g. Video Print, Laser print, DICOM storage...etc.) can be associated to the keys (i.e. hitting **PRINT** can result in printing a Color video print and storage to a DICOM media).



1. **Select between PRINT and ALT keys.**
2. **Available output devices that can be assigned to the current button.**
3. **Output devices assigned to the current button.**
4. **Add or remove selected device to/from the current button.**
5. **Adjust the device settings for the selected assigned device**
6. **Select the type of images to produce and adjust image settings. These settings will overrule the adjustment made in the *Properties window*.**

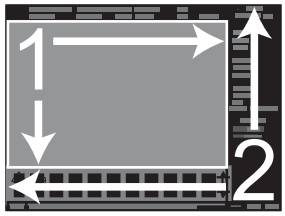
Figure 12-16: The sublevel Additional outputs (example)

The image configuration parameters

The table below gives a list of the configuration parameters.

To configure the Print or Alt. Print key

1. In *Button field* select **Print** or **Alt. Print**.
2. Select an **output device** in the *available outputs field* and press the **Right arrow button** to assign the service to the dataflow.
3. Press **Properties**.
   The *Properties window* is displayed.
4. Adjust the device specific parameters as desired.
   Some of the settings can be changed directly in the *Image to Produce field* in the sublevel Additional outputs.

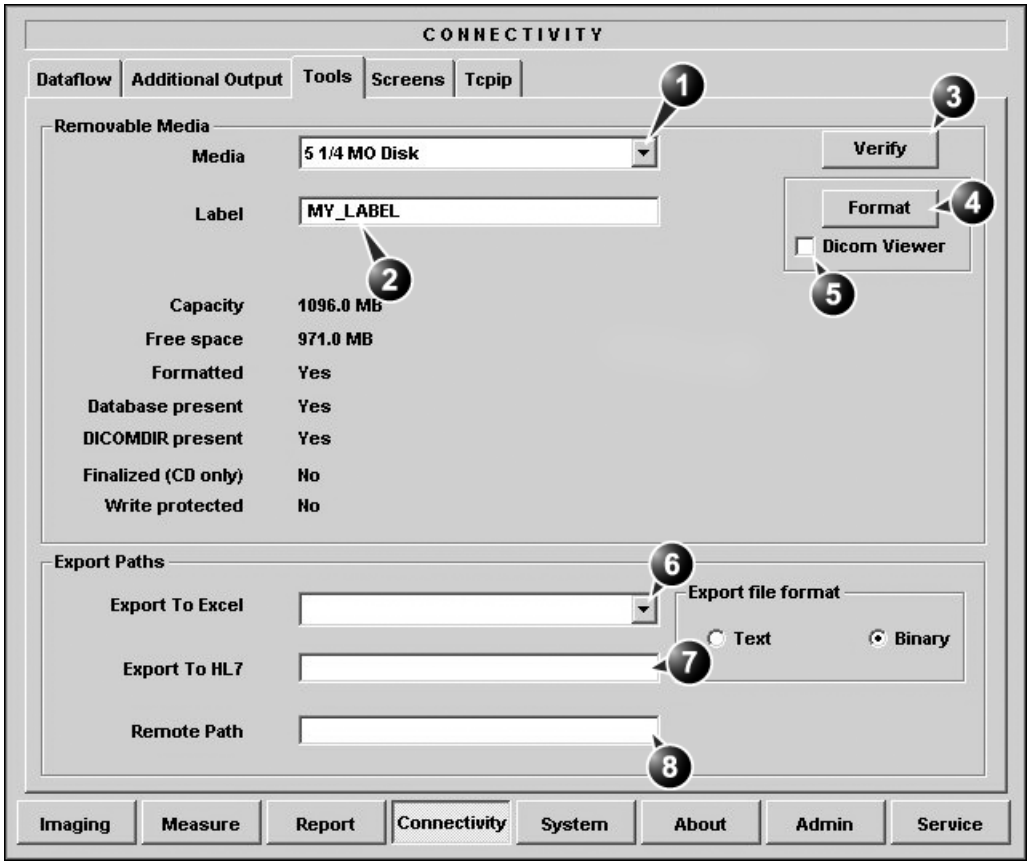
Configuration parameter	
Format	Select between: • Raw DICOM • DICOM • AVI • JPEG
Image frames	Select between: • **Single**: stores single frame only • **Multiple**: stores cineloop • **Secondary Capture**: screen shot
Image compression	Select compression mode from the pop-up menu.
Quality	Set picture quality from 1 to 100%. A low picture quality level allows high data compression, while a high picture quality restrains the compression.
Capture Area	Select between: • Video Area (1) • Whole Screen (2) 

To remove a device, select the device in the *Selected devices field* and press the **Left arrow button**.

Tools

The *Tools sublevel sheet* deals with:

- formatting of removable media (MO disk, CD-R or ZIP disk).
- verification of DICOM directory on removable media.



1. **Select removable media to verify/format**
2. **Label a new removable MO disk (free text)**
3. **Verify DICOM directory on removable DICOM disk**
4. **Start formatting**
5. **Install a DICOM viewer**
6. **Select the device for patient information exported as Excel**
7. **Set the path for the repository for HL7 export (format: \\server-name\share-name)**
8. **Set a user-defined remote path for Save as function and export to Excel.**

Figure 12-17: The sublevel Tools

Formatting a removable media

1. Select the removable media from the *Media pop-up menu*.
2. Enter a name for the removable media in the *Label field*.
3. Check **DICOM viewer** is desired.
   DICOM viewer enables the display of DICOM images from the removable media without the need of any other software.
4. Press **Format**.
5. Wait for the display of the *Information window* indicating that the formatting process is completed.

Do not eject the CD using the button on the CD drive

6. Press **ALT**+**E** to eject the disk.

Verifying a removable media

1. Insert the removable media to verify.
2. Select the pre-configured removable media from the *Media pop-up menu*.
3. Press **Verify**.
   The unit is verifying the DICOM directory on the selected media.

Formats

The *Formats sublevel* enables configuration of the *Examination list window* (see page 284) and other tools related to patient management, as described below.

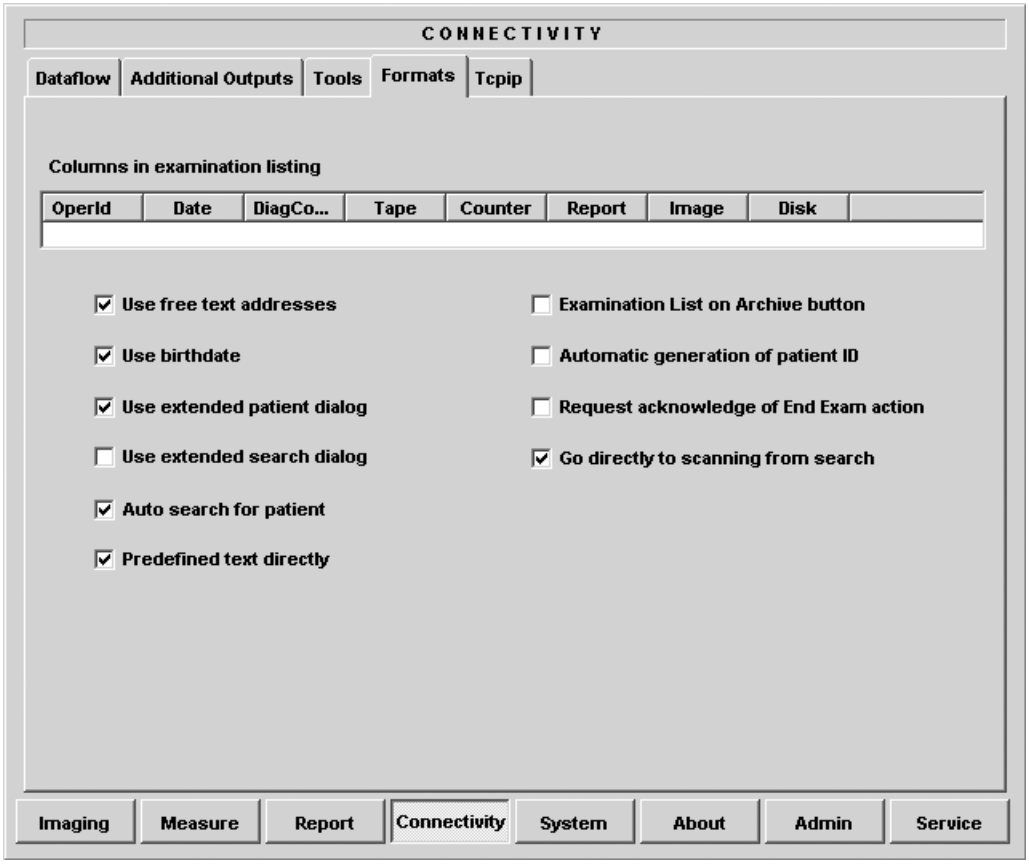


Figure 12-18: The sublevel Formats (example)

Configuration of the Examination list window

The user can configure the examination list displayed in the *Examination list window* (see page 284) by deleting, adding columns and change the information type displayed in each column.

To adjust column width, select and drag column heading border.

Column configuration

1. Trackball to the column to edit.
2. Press the **SELECT** key in the trackball area.
   A sub-menu is displayed (see Figure 12-19).
3. Select the action to perform:
   - **Insert**: creates a new column
   - **Delete**: removes selected column
   - select the desired information to be displayed in the selected column.

1. **Insert new column to the left of the selected column**
2. **Delete selected column**
3. **Select column heading**

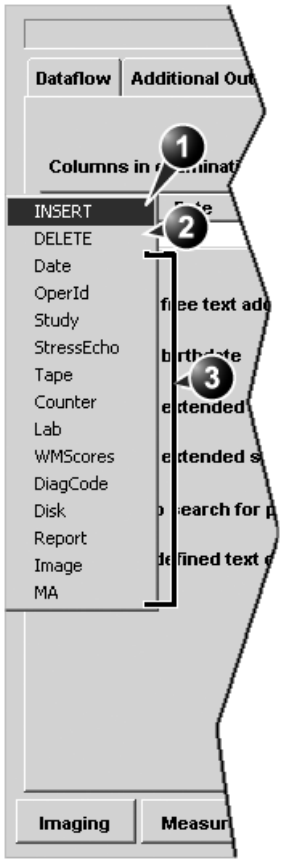


Figure 12-19: Configuration of the Examination list window

Other configuration settings

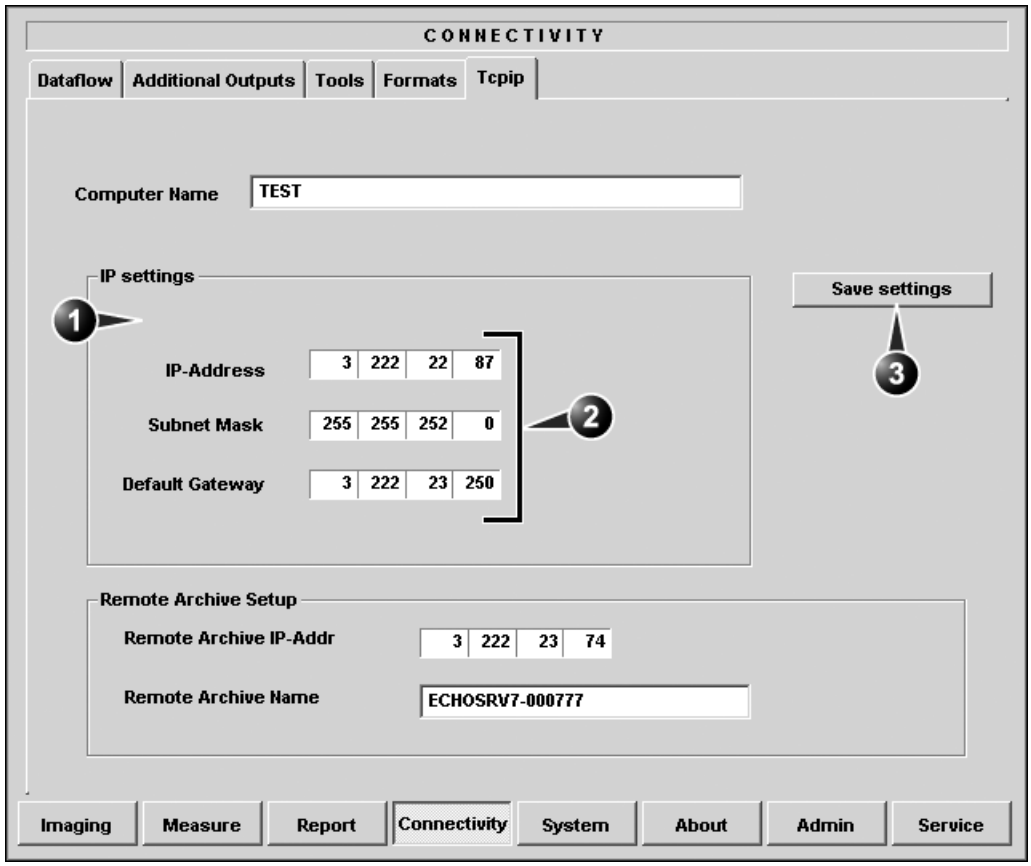
Parameter	Description
☑ Use free text addresses	**Use free text addresses:** In the *Patient information window* (see page 52), ☑: The address information (e.g. street, city...etc.) is entered in type-specific fields. ☐: The address information is entered in a single field (free text).
☑ Use birthdate	**Use Date of birth:** In the *Patient information window* (see page 52), enter either the patient age or the birth date: ☑: Enter age (Date of birth field not available) ☐: Enter Date of birth, the age is calculated.
☑ Use extended patient dialog	**Use extended patient dialog:** In the *Patient information window* (see page 52), ☑: The entire patient information data is displayed. ☐: Patient information data displayed is restricted to a minimum (e.g. name and Patient ID). When unchecked, press **More** to display the entire patient information data.
☐ Use extended search dialog	**Use extended search dialog:** In the *Search/Create Patient window* (see page 51, page 280 and page 282), ☑: All the searching filters are displayed as default. ☐: The searching criteria are restricted to a minimum. When unchecked, press **More** to display all the searching filters.

Parameter	Description
☑ Auto search for patient	**Auto search for patient:** In the *Search/Create Patient window* (see page 51, page 280 and page 282), ☑: The system searches automatically through the patient archive selected while entering patient information. ☐: The system searches through the patient archive after pressing **SELECT**.
☑ Predefined text directly	**Pre-defined text directly:** In the *Examination list window* (see page 284), ☑: the Insert text key launches pre-defined text input. ☐: the **Insert text** key open the extended text field.
☐ Examination List on Archive button	**Examination list on Archive button** When a patient is selected, pressing **ARCHIVE** will: ☑: open the *Examination list window* for the selected patient. ☐: open the *Patient Information window* for the selected patient.
☐ Automatic generation of patient ID	**Automatic generation of patient ID:** In the *Search/Create Patient window* (page 51), ☑: Patient ID is not required when entering a new patient in the archive. The system generates automatically an ID number. ☐: Patient ID is required when entering a new patient in the archive.
☐ Request acknowledge of End Exam action	**Request acknowledge of End Exam action:** ☑: The user is asked to confirm action when ending an examination.

Parameter	Description
☑ Go directly to scanning from search	**Go directly to scanning from search:** ☑: The unit goes directly to the *Scanning screen* after selecting/creating patient record. ☐: The unit displays the *Patient information window* after selecting/creating patient record for further information entry. The user must press **Begin Exam** to enter the *Scanning screen*.

TCP/IP

This configuration category enables the user with administration rights to set the Transmission Protocol/Internet Protocol for the system and connected remote archive.



1. **obtain an IP address automatically**
2. **Manually specify IP address and subnet mask**
3. **Save TCP/IP settings**

Figure 12-20: The sublevel TCP/IP

System

This configuration category is divided in two sheets:

- **System Settings**: enables the user to set the date and time, choose the measurement unit and language for the system and enter basic information about the organization, such as the institution name and department.
- **Test**: enables testing of the different parts of the unit.

This sheet is accessible to users with administration rights only.

The system settings

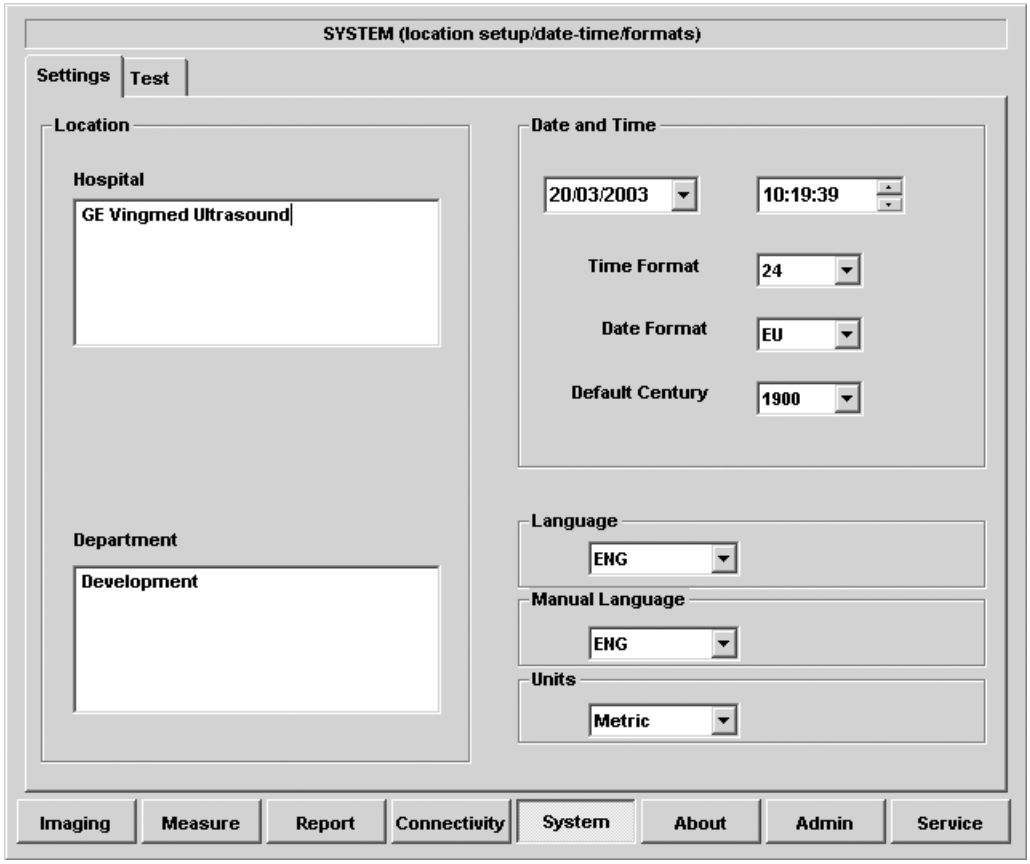
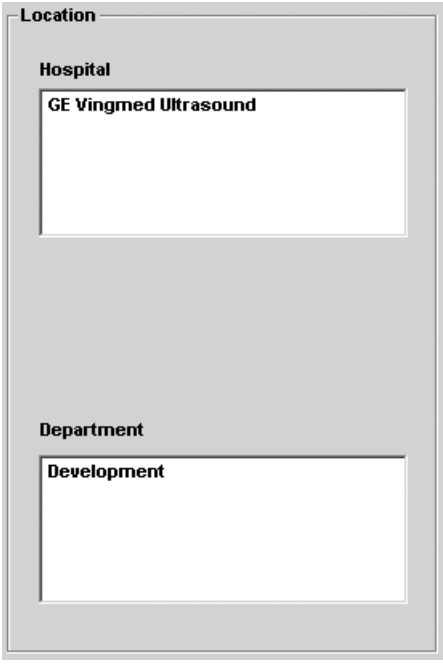
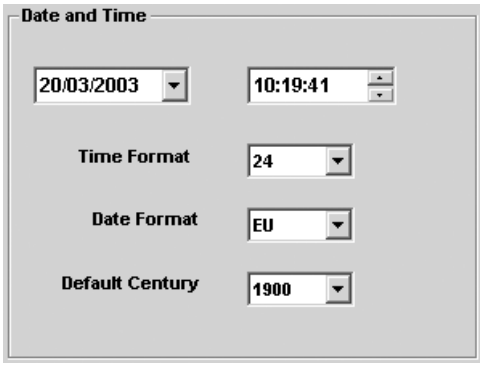


Figure 12-21: The System settings setup sheet

Location

Parameter	Description
	**Location:** • **Hospital**: Enter the hospital name (up to 64 characters). This information is displayed on the scanning screen's *Title bar* (up to 24 characters) and on the image properties of all saved images. • **Department**: Enter the department name (up to 64 characters). This information is displayed on the image properties of all saved images.

Date and Time

Parameter	Description
 Changes done on the date or time format will be effective only after rebooting the system.	**Date and Time:** • **Date**: sets the date. Select the correct date from the pop-up window. • **Time**: sets the time. Press the arrow head buttons to set the time (hour minute and second). • **Time Format**: select the desired format (24 or 12AM/PM) from the pop-up menu. • **Date Format**: select the desired format (EU or US) from the pop-up menu. • **Default Century**: select the desired format (1900, 2000 or None) from the pop-up menu. **1900**: the number 19 is automatically displayed when entering the year in the patient date of birth (to edit century, press **BACKSPACE** twice). **2000**: the number 20 is automatically displayed when entering the year in the patient date of birth (to edit century, press **BACKSPACE** twice). **None**: the four digits have to be typed when entering the year in the patient date of birth.

Languages

Parameter	Description
	Language: Select the desired language for the system from the pop-up menu. **Manual language:** Select the desired language for the Online manual. If not available the English manual will be displayed as default.

Units

Parameter	Description
	Units: Select the desired units (Metric or US) from the pop-up menu.

About

The About sheet gives informations about the ultrasound unit concerning:

- software
- hardware
- Probes

Administration

Only users with administration rights have access to this setup category (see page 449).

The Admin. category is divided in five sheets:

- **Backup**: enables the backup procedures for local patient, and report archives as well as system and user-defined configuration (see page 328).
- **Restore**: enables data retrieving of patient and report archives as well as system and user-defined configuration (presets) from a backup (see page 328).
- **Users**: deals with operators registration, operator's rights setting and registration of staff related to an examination (e.g. referral doctors, sonographers...etc.).
- **Logon**: deals with logon procedure.
- **System Administration**: keeps track of all the options implemented in the unit.

Users

The *Users sheet* deals with operators registration, operator's rights setting and registration of referring members related to examinations (e.g. referring and diagnosing physicians).

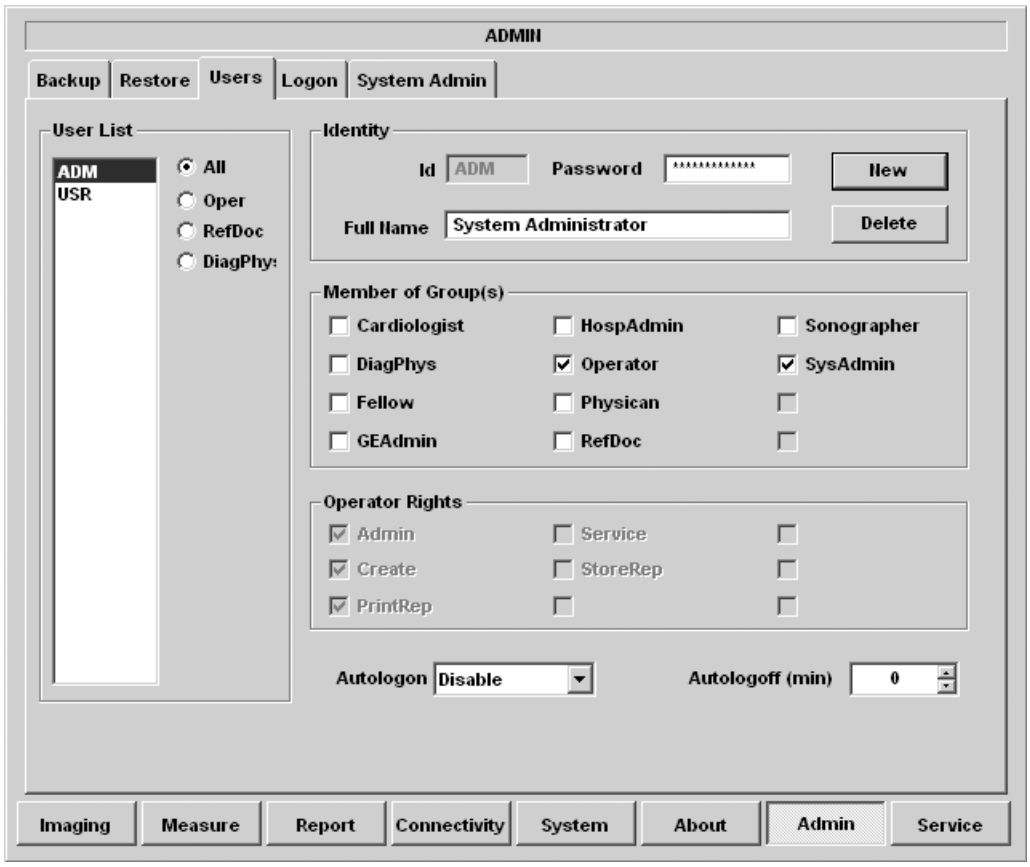


Figure 12-22: The Users setup sheet

Users are divided in groups with different rights. There are two types of groups:

- **User groups**: members of these groups (see table below) are allowed to login on the system when selected together with the group Operator. They have group specific rights.
- **Referring groups**: members of these groups (Diagnosing physician and Referring doctor) are not allowed to login on the system. They are registered as references that can be

associated to a patient record.

Table 12-1: The User groups

	Right (see definition below)				
Group	**Create**	**Print report**	**Store report**	**Admin**	**Service**
Cardiologist	+	+	+		Activated with a Dongle
Physician	+	+			
Sonographer	+	+			
Fellow	+	+			
Sys Admin	+	+		+	
Hosp admin		+			
GE admin	+	+		+	

The rights associated to the user groups are:

Right	Definition
Create and delete	• Create, update and delete a patient record • Create, update and delete an examination • Create, update and delete an user or a referring member • Import/Export patient records, examinations • Move examinations
Print report	• Print a report
Store report	• Store a report
Admin	• System administration
Service	• Access to the service platform

Creating a user or a referring member

1. Press **New**
2. Enter:
   - the person ID (usually initials)
   - a password
   - The full name

3. Select the type of user/referring member in *Member of Group(s)*.

△
CAUTION

To be able to login on the system, the group Operator MUST be selected.

Editing an user configuration

1. Select the actual user in the *User list*.
2. Make the desired changes.
3. Press **CONFIG** or any active scanning key to exit the Configuration management package.

Deleting a user

1. Select the actual user in the *User list*.
2. Press **Delete**.
   The user is removed from the *User list*.

Auto logon and auto logoff

Auto logon

1. Select the desired logon setup from the pull down menu:
   - **Disabled**: no default user is selected when logging on.
   - **Last user**: the last user is selected automatically when logging on.
   - **A specific user**: select one of the users to be the default user when logging on.

Auto logoff

1. Set the time span (from 10 min) for the system to automatically log off when not in use.

Logon

The *Log on sheet* deals with the on-logging procedure.

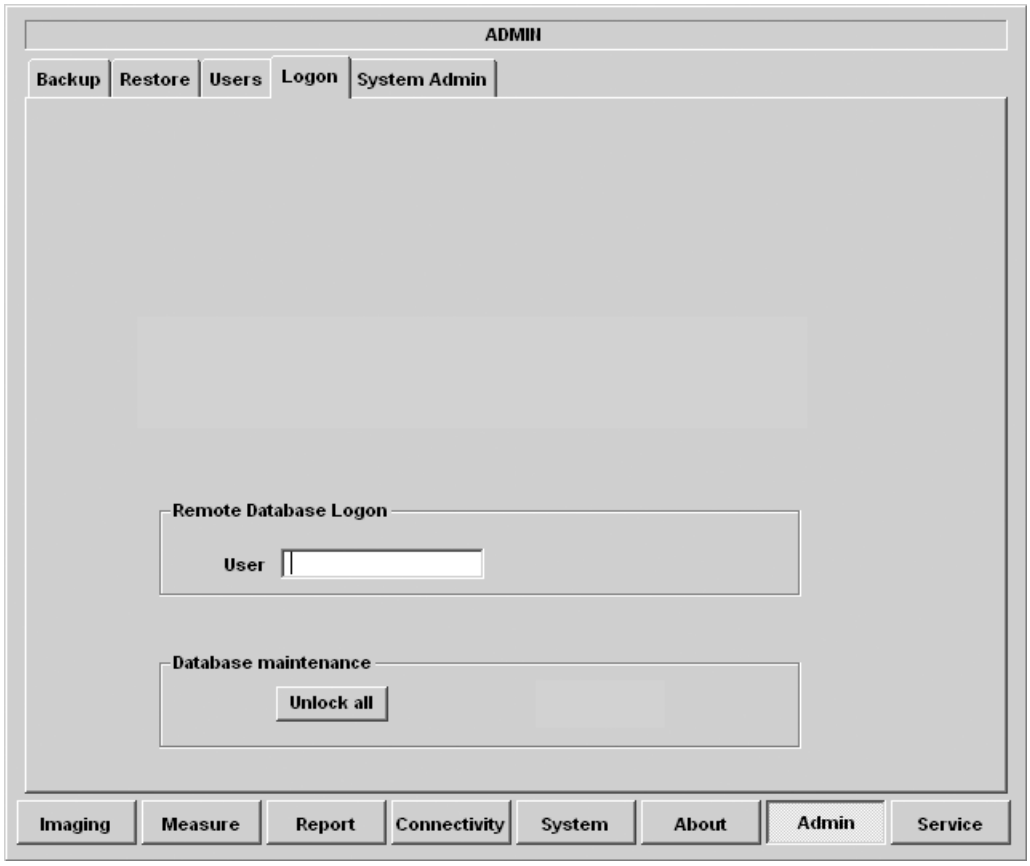


Figure 12-23: The Log on sheet

Remote Database Logon:

Give access to the network, refer to your network specifications.

Unlock all:

Unlock all lock patient records in the local database. Patient records are locked if an examination is not terminated properly or if it is opened.

Chapter 13
User maintenance

This chapter includes the following information:

- **System Care and Maintenance 454**
  - Inspecting the system 454
  - Cleaning the unit 455
  - Air filter 455
  - Prevention of static electricity interference 457
- **Troubleshooting 458**
  - System malfunction 458

System Care and Maintenance

CAUTION

The user must ensure that safety inspections are performed at least every 12 months according to the requirements of the patient safety standard IEC 60601-1 (1988).

Only trained persons are allowed to perform the safety inspections mentioned above.

Technical descriptions are available on request.

To ensure that the Vivid 7/Vivid 7 PRO unit constantly operates at maximum efficiency we recommend that the following procedures be observed as part of the customer's internal routine maintenance program.

Inspecting the system

CAUTION

If any defects are observed or malfunctions occur, DO NOT operate the equipment, and inform a qualified service person.

Monthly

Examine the following on a monthly basis (or whenever there is a reason to assume that any issue may have occurred):

- Connectors on cables, for any mechanical defects
- Entire length of electrical and power cables, for cuts or abrasions
- Equipment, for loose or missing hardware
- Control panel for defects
- Brakes

WARNING

To avoid electrical shock hazard, do not remove panels or covers from the unit.

Cleaning the unit

Weekly

The Vivid 7/Vivid 7 PRO ultrasound unit requires weekly care and maintenance to function safely and properly. The following components should be cleaned:

System cabinet

1. Moisten a soft, non-abrasive folded cloth with a mild, general purpose, non-abrasive soap and water solution or a general purpose disinfectant.
2. Wipe down the top, front, back and both sides of the cabinet. **Do not spray any liquid directly into the unit.**

Monitor

1. Apply a glass cleaner to a soft non-abrasive folded cloth.
2. Gently wipe the monitor face.

Diligent cleaning of the Vivid 7 console reduces the risk of spreading infection from person to person, and also helps to maintain a clean working environment.

Control panel

1. Turn off the power to the system.
2. Moisten a soft, non-abrasive folded cloth with water or a mild, non-abrasive soap and water solution.
3. Gently wipe the surface of the console.

For difficult spots or general cleaning, an all-purpose cleaner may also be used.

Air filter

Every three months

Clean the unit's air filter to ensure that a clogged filter does not cause the unit to overheat and reduce system performance and reliability.

The air filter is situated in the back of the system.

1. **Filter cover**
2. **Air intake locations**
3. **Handle**

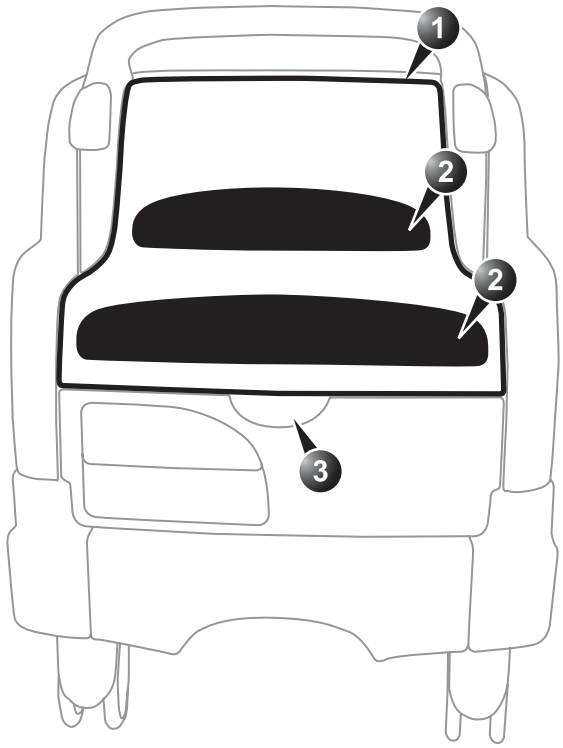


Figure 13-1: The air filter location

To remove the filter

1. Grab the filter cover by the handle and pull away the cover from the unit (see Figure 13-1).
2. Pull away the four clips holding the filter.
3. Remove the filter from the air duct.

WARNING

DO NOT operate the unit without filter.

To clean the filter

1. Shake the filter in an area away from the unit.
2. Wash the filter with a mild soapy solution.
3. Rinse and dry the filter.

WARNING

Allow the filter to dry thoroughly before re-installing it in the unit.

Prevention of static electricity interference

Interference from static electricity can damage electronic components in the system. The following measures help to reduce the likelihood of electrostatic discharge:

- Wipe the alphanumeric keyboard and monitor with lint-free tissue or a soft cloth dampened with anti-static spray on a monthly basis.
- Spray carpets with anti-static spray because constant walking on carpets in or near the scanning room may be a source of static electricity.

Troubleshooting

The Vivid 7/Vivid 7 PRO ultrasound unit is engineered for reliable operation and consistent, high-quality performance. Automatic self-testing facilities are provided to monitor system operation and to detect faulty operation as soon as possible, thereby eliminating unnecessary downtime. The detection of any serious malfunction results in immediate interruption of scanning, and is indicated by an error message on the monitor screen.

System malfunction

In the event of error or system malfunction generate a log file as described below and contact authorized service personnel.

Generating a logfile

1. Press **ALT** - **D** on the alphanumeric keyboard.
   The *Problem description dialogue window* is displayed.

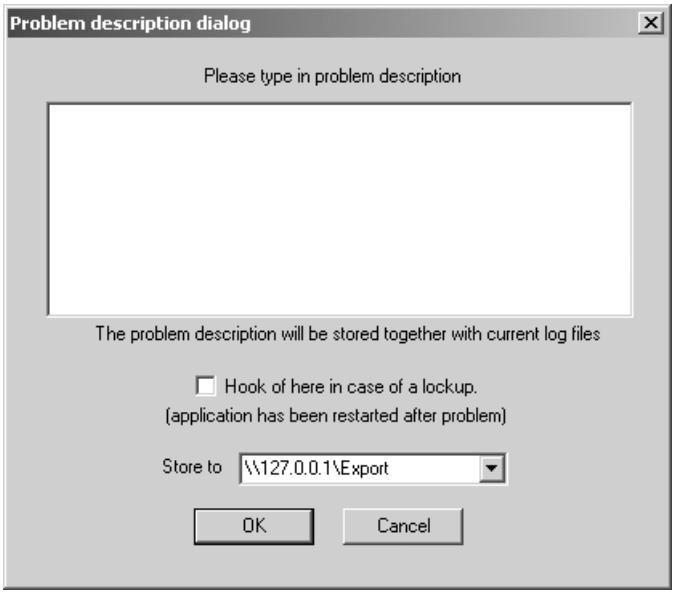

Problem description dialog
Please type in problem description
The problem description will be stored together with current log files
Hook of here in case of a lockup.
(application has been restarted after problem)
Store to
\\127.0.0.1\Export
OK
Cancel

Figure 13-2: The Problem description dialogue window

2. Type in a description of the problem. Notes should be made regarding the selected probe, the imaging mode and the application that was being used at the time of malfunction.

If applicable, try to record the button or key pushing sequence that immediately preceded the problem.

3. Select where to store the logfile.
4. Press **OK**.
5. Turn the unit off (see page 18)
6. Do not use the unit until authorized service personnel have restored it to its fully operational state.

Chapter 14
Safety

This chapter includes the following information:

- **Introduction 463**
- **Owner responsibility 464**
- **Important safety considerations 465**
  - Notice against user modification 465
- **Regulatory information 466**
  - Standards used 466
- **Device labels 468**
- **Acoustic output 471**
  - Definition of the acoustic output parameters 471
  - Acoustic output and display on the Vivid 7/Vivid 7 PRO 472
  - ALARA 473
  - Safety statement 473
  - System controls affecting acoustic output 473
- **Patient safety 476**
  - Patient identification 476
  - Diagnostic information 476
  - Mechanical hazards 476
- **Personnel and equipment safety 478**
  - Explosion hazard 478
  - Implosion hazard 478
  - Electrical hazard 478
  - Moving hazard 479
  - Biological hazard 479
  - Pacemaker hazard 480
- **Electrical safety 481**
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  - Internally connected peripheral devices 481

• External Connection of other peripheral devices 481
• Allergic reactions to latex-containing medical devices 482
• Electromagnetic Compatibility (EMC) 483
• Environmental protection 485
• System disposal 485

Introduction

This section describes the important safety measures which should be taken before operating the Vivid 7/Vivid 7 PRO ultrasound unit. Procedures for simple care and maintenance of the unit are also described.

Various levels of safety precautions may be found on the equipment, and different levels of severity are identified by one of the following icons that precede precautionary statements in the text.

The following icons are used to indicate precautions:

DANGER

Indicates that a specific hazard exists that, given inappropriate conditions or actions, will cause:

- Severe or fatal personal injury
- Substantial property damage

WARNING

Indicates that a specific hazard exists that, given inappropriate conditions or actions, will cause:

- Severe or fatal personal injury
- Substantial property damage

CAUTION

Indicates that a potential hazard may exist that, given inappropriate conditions or actions, can cause:

- Minor injury
- Property damage

Marks sections or chapters in the user manual which give information related to components on the ultrasound unit or to accessories marked with this same label (see also page 469).

Other precautions or prudent-use recommendations are indicated in the note sections in the left column. These are:

- Use of the **Vivid 7/Vivid 7 PRO** ultrasound unit as a prescription device, under the order of a physician.
- Maintaining an optimum unit environment.
- Reference to the User's Manual.

Owner responsibility

△
CAUTION

For USA only:

Federal law restricts this device to use by, or on the orders of, a physician.

It is the responsibility of the owner to ensure that anyone operating the system reads and understands this section of the manual. However, there is no representation that the act of reading this manual renders the reader qualified to operate, inspect, test, align, calibrate, troubleshoot, repair or modify the system. The owner should make certain that only properly trained, fully-qualified service personnel undertake the installation, maintenance, troubleshooting, calibration and repair of the equipment.

The owner of the Vivid 7/Vivid 7 PRO ultrasound unit should ensure that only properly trained, fully qualified personnel are authorized to operate the system. Before authorizing anyone to operate the system, it should be verified that the person has read, and fully understands, the operating instructions contained in this manual. It is advisable to maintain a list of authorized operators.

Should the system fail to operate correctly, or if the unit does not respond to the commands described in this manual, the operator should contact the nearest field GE Ultrasound Service Office.

For information about specific requirements and regulations applicable to the use of electronic medical equipment, consult the local, state and federal agencies.

Important safety considerations

Notice against user modification

Never modify this product, including system components, software, cables, and so on. User modification may cause safety hazards and degradation in system performance. All modification must be done by a GE qualified person.

This section includes considerations for the following:

- Patient safety
- Personnel and equipment safety

The information contained in this section is intended to familiarize the user with the hazards associated with the use of the unit, and to alert them to the extent to which injury and damage may occur if the precautions are not observed.

Users are obligated to familiarize themselves with these safety considerations and to avoid conditions that could result in injury or damage.

Regulatory information

The GE Vingmed Ultrasound product families are tested to meet all applicable requirements in relevant EU Directives and European/International standards. (See “Standards used” below.) Any changes to accessories, peripheral units or any other part of the system must be approved by the manufacturer: GE Vingmed Ultrasound. **Ignoring this advice may compromise the regulatory approvals obtained for the product.**

Please consult your local GE Vingmed Ultrasound representative for further details.

Standards used

The Vivid 7/Vivid 7 PRO ultrasound unit is a Class I device, type CF, according to Sub-clause 14 of IEC 60601-1 (1988). To fulfill the requirements of relevant EC directives and/or European Harmonized/International standards, the following documents/standards have been used:

Standard/Directive	Scope
93/42/EEC	Medical Devices Directive (MDD)
EN 55011/CISPR 11/ 3.1991	Emitted noise according to Class B requirements + Electromagnetic Susceptibility
IEC 60601-1 (1988) EN 60601-1 (1990) UL 2601-1/ 8 (1994)	Medical Electrical Equipment, Part 1; General Requirements for Safety “CLASSIFIED BY UNDERWRITERS LABORATARIES INC WITH RESPECT TO ELECTRICAL SHOCK, FIRE AND MECHANICAL HAZARDS ONLY IN ACCORDANCE WITH UL2601-1 AND CAN/CSA C22.2 NO.601.1”
IEC 1157/ EN 61157/ (1994)	Requirements for the declaration of the acoustic output of medical diagnostic ultrasonic equipment.
EN 60601-1-2 (2001)	Medical Electrical Equipment - part 2. Collateral standard: Electromagnetic compatibility - Requirements and tests.

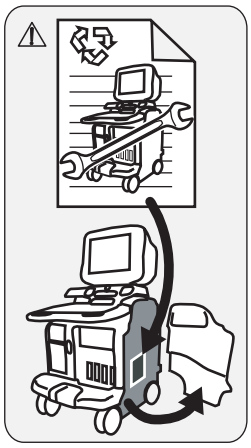
Note: Any rest energy within our scanners or their components will be below 60V DC or 2 mJ.

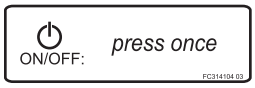
CE 0470

Device labels

The following table describes the purpose and location of safety labels and other important information provided on the equipment.

Label/Icon	Purpose	Location
Identification Plate	Manufacturer's name and address Model Electrical ratings Device Listing/Certification Labels	Rear
	Equipment Type BF, in which protection against electric shock does not rely on basic insulation only. Provides additional safety precautions such as double insulation or reinforced insulation, because there is no provision for protective earthing or reliance upon installation conditions.	Probe connectors.
	Equipment Type CF, indicates equipment having a floating applied part having a degree of protection suitable for direct cardiac contact.	ECG connector
	Defibrillator-proof Type CF equipment.	ECG connector
CE 0470		Rear of unit.
	Alternating current	Various
	Protective earth (ground)	Internal

Label/Icon	Purpose	Location
	Earth (ground)	Internal
	Equipotentiality: indicates terminal to be used for connecting equipotential conductors when interconnecting (grounding) with other equipment.	Rear of unit
	Attention - Consult accompanying documents: alerts the user to refer to the user documentation when complete information cannot be provided on the label.	Various
	CAUTION - Dangerous voltage: used to indicate electric shock hazards.	Various
	ATTENTION - Observe precaution for handling electrostatic sensitive device.	Rear of unit (External I/O)
	The system is not designed for use with flammable anesthetic gases.	Rear of unit (Identification plate)
	The disassembly and parts disposition procedure is located on the card cage front cover. To access to the procedure, remove the right side panel by unscrewing the two screws on the lower part.	Rear of unit (Identification plate)

Label/Icon	Purpose	Location
	This precaution is intended to prevent injury that may result if one person attempts to move the unit over considerable distances or on an incline due to the weight of the unit.	Rear of unit (Identification plate)
	CAUTION - Do not move the unit if the keyboard console is in the free position	Keyboard console
	Apply a short push on the ON/OFF button to shut down the system.	Keyboard console

Acoustic output

Definition of the acoustic output parameters

Thermal Index

TI is an estimate of the temperature increase of soft tissue or bone. There are three thermal index categories:

- TIS: Soft tissue thermal index. The main TI category. Used for applications that do not image bone.
- TIB: Bone thermal index (bone located in a focal region). Used for fetal application.
- TIC: Cranial bone thermal index (bone located close to the surface). Used for transcranial application.

Mechanical Index

MI is the estimated likelihood of tissue damage due to cavitation. The absolute maximum limits of the MI is 1.9 as set by the FDA 510(k) guidance of 1997.

Ispta

The Ispta is the Spatial Peak Temporal Average Intensity. The absolute maximum limit of Ispta is 720 MW/cm^2 as set by the FDA 510(k) guidance of 1997.

Acoustic output and display on the Vivid 7/Vivid 7 PRO

In the title bar, two fields are allocated for the display of power values as shown in Figure 14-1.

1. **Title bar**
2. **MI**
3. **TI**

Figure 14-1: The display of MI and TI on the screen

The Vivid 7/Vivid 7 PRO chooses the correct category based on mode of operation and chosen application, and presents only one TI to the operator. It is therefore important that the operator chooses the right application.

The Vivid 7/Vivid 7 PRO has an internal limit of 3.0 on TI. IEC87 has suggested some time dependent thresholds that are partly implemented on the Vivid 7/Vivid 7 PRO as color-coding of the thermal index. The color-coding scheme together with the thermal exposure times in the table below are not meant as limits on TI or exposure time, but as an aid for the operator. Note that the Vivid 7/Vivid 7 PRO does not monitor the thermal exposure time. The displayed TI is coded as follow:

TI	Color	Recommended thermal exposure time
0.0 – 0.4	Dimmed	-
0.4 – 1.5	White	-
1.5 – 2.0	White	< 12 h
2.0 – 3.0	White	< 1 h
3.0 – 4.0	Red	< 15 min.

The maximum possible MI and Ispta on the Vivid 7/Vivid 7 PRO is within the limits set in Track 3 in the FDA 510(k) guide of 1997, MI<1.9 and Ispta<720 mW/cm^2.

ALARA

Ultrasound procedures should be performed using output levels and exposure times As Low As Reasonably Achievable (ALARA) while acquiring clinical information.

Training

During each ultrasound examination the user is expected to weigh the medical benefit of the diagnostic information that would be obtained against the risk of potential harmful effects. Once an optimal image is achieved, the need for increasing acoustic output or prolonging the exposure cannot be justified. It is recommended that all users receive proper training in applications before performing them in a clinical setting. Contact the GE Ultrasound sales representative for training assistance.

Safety statement

GE Vingmed Ultrasound safety statement

Although no harmful biological effects have been demonstrated for ultrasound frequencies, intensities and exposure times used in examination with the GE Vingmed Vivid 7/Vivid 7 PRO system, GE Vingmed Ultrasound recommends using the lowest acoustic output settings which will produce diagnostically acceptable information.

System controls affecting acoustic output

The operator controls that directly affect the acoustic output are discussed in the Acoustic Output Data Tables in the Reference Manual. These tables show the highest possible acoustic intensity for a given mode, obtainable only when the maximum combination of control settings is selected. Most settings result in a much lower output. It is important to note the following:

- The duration of an ultrasound examination is as important as the acoustic output, since patient exposure to output is

directly related to the exposure time.

- Better image quality yields faster clinical results, making it possible to complete the relevant ultrasound examination more rapidly. Therefore, any control that improves the quality of the examination can help to reduce patient exposure, even though it may not directly affect acoustic output.

Probe selection

As long as the appropriate application is available, any probe can be used with the knowledge that the intensities fall at, or below, those stated in the Acoustic Output Data Tables. The duration of patient exposure is most likely minimized with the use of a probe that is optimized to provide resolution and focal depth, appropriate to the examination.

Application selection

Selecting the probe and application preset appropriate to a particular ultrasound examination automatically provides acoustic output limits within FDA guidelines for that application. Other parameters which optimize performance for the selected application are also set automatically, and should assist in reducing the patient exposure time. See page 53, for information on selecting probes and application presets.

Changing imaging modes

Acoustic output depends on the imaging mode selected. The choice of mode (2D, M-Mode, Doppler or Color Flow) determines whether the ultrasound beam is stationary or in motion. This greatly affects the energy absorbed by the tissue.

See Chapter 3, ’Scanning Modes’ on page 89, for complete information on changing imaging modes.

When operating in a combined mode, such as 2D and M-Mode, the total acoustic output comprises contributions from each individual mode. Depending on the modes in use, either or both output indices may be affected.

The user can override the default settings, but care should be taken to observe the displayed MI and TI values.

Power

It is possible to change the power in all operating modes so that the operator can use the ALARA principle.

Patient safety

Patient identification

WARNING

The concerns listed in this section can seriously affect the safety of the patient undergoing a diagnostic ultrasound examination.

Always include proper identification with all patient data and verify the accuracy of the patient's name and/or identity number when entering such data. Ensure that the correct patient ID is provided on all recorded data and hard copy prints. Identification errors could result in an incorrect diagnosis.

Diagnostic information

The images and calculations provided by the system are intended for use by competent users, as a diagnostic tool. They are explicitly not to be regarded as the sole, irrefutable basis for clinical diagnosis. Users are encouraged to study the literature and reach their own professional conclusions regarding the clinical utility of the system.

The user should be aware of the product specifications and of the system accuracy and stability limitations. These limitations must be considered before making any decision based on quantitative values. If in doubt, the nearest GE Ultrasound Service Office should be consulted.

Equipment malfunction or incorrect settings can result in measurement errors or failure to detect details in the image. The user must become thoroughly familiar with the operation of the unit in order to optimize its performance and to recognize possible malfunctions. Application training is available through the sales representative.

CAUTION

Be certain to ensure privacy data of patient information.

Mechanical hazards

Damaged probes or improper use and manipulation of the transesophageal probe may result in injury or increased risk of

infection. Inspect probes frequently for sharp, pointed or rough surface damage that could cause injury or tear protective barriers (gloves and sheaths).

Transesophageal probe safety

Never use excessive force when manipulating the transesophageal probe. The detailed operator manual enclosed with the transesophageal probe must be read carefully.

Electrical Hazard

A damaged probe may increase the risk of electric shock if conductive solutions come in contact with internal live pads. Inspect probes often for cracks or openings in the housing and holes in and around the acoustic lens, or other damage that could allow moisture to enter. Become familiar with the use and care precautions described in Chapter 10, ’Probes’ on page 355.

Personnel and equipment safety

DANGER

The hazards listed below can seriously affect the safety of personnel and equipment during a diagnostic ultrasound examination.

Explosion hazard

Never operate the equipment in the presence of flammable or explosive liquids, vapors or gases. Malfunctions in the unit, or sparks generated by fan motors, can electrically ignite these substances. Operators should be aware of the following points to prevent such explosion hazards.

- If flammable substances are detected in the environment, do not plug in or turn on the system.
- If flammable substances are detected after the system has been turned on, do not attempt to turn off the unit, or to unplug it.
- If flammable substances are detected, evacuate and ventilate the area before turning off the unit.

Implosion hazard

Do not subject the unit to serious mechanical shocks because the cathode ray tube (CRT) may implode if struck or jarred. This may cause pieces of glass and/or phosphor coating to fly into the air and result in serious injury.

Electrical hazard

WARNING

The internal circuits of the unit use high voltages, capable of causing serious injury or death by electrical shock.

To avoid injury:

- Do not remove the unit's protective covers. No user-serviceable parts are inside. If servicing is required, contact qualified technical personnel.
- Connect the attachment plug to a hospital-grade grounding outlet to ensure adequate grounding.
- Do not place liquids on or above the unit. Conductive fluids

seeping into the active circuit components may cause short circuiting, which could result in an electrical fire.

- An electrical hazard may exist if any light, monitor or visual indicator remains on after the unit is turned off.

Fuses blown within 36 hours of being replaced may indicate a malfunctioning electrical circuit within the system. In this event, the unit must be checked by GE Ultrasound service personnel. No attempt should be made to replace the fuses with others of a higher rating.

Moving hazard

△
CAUTION

The Vivid 7/Vivid 7 PRO unit weighs approximately 190 Kg (419 lb.).

Special care must be used to avoid injury when moving or transporting the unit.

- Always be sure the pathway is clear.
- Limit the speed of movement to a careful walk.
- Use at least two people when moving the unit on inclines.

Ensure that the unit is well prepared before transporting. Refer to ’Moving and transporting the unit’ on page 21 for more information.

Biological hazard

For patient and personnel safety, beware of biological hazards while performing transesophageal procedures. To avoid the risk of disease transmission:

- Use protective barriers (gloves and probe sheaths) whenever necessary. Follow sterile procedures as required.
- Thoroughly clean probes and reusable accessories after each patient examination and disinfect or sterilize as needed. Refer to Chapter 10, ’Probes’ on page 355, for probe use and care instructions.
- Follow all in-house infection control policies as they apply to personnel and equipment.

Pacemaker hazard

The possibility of the system interfering with pacemakers is minimal. However, as this system generates high frequency electrical signals, the operator should be aware of the potential hazard this could cause.

Electrical safety

Device classifications

The Vivid 7/Vivid 7 PRO ultrasound unit is a Class I device, type CF, according to Sub-clause 14 of IEC 60601-1 (1988).

Internally connected peripheral devices

The system, together with peripheral devices, such as video tape recorders and printers, meets UL 2601-1 and IEC 60601-1 (1988) standards for electrical isolation and safety. These standards are applicable only when the specified peripheral devices are plugged into the AC outlets provided in the unit.

External Connection of other peripheral devices

△
CAUTION

External devices can be used only if CE marked and in compliance with related standards (EN 60601-1 or EN 60950). Conformance to EN 60601-1-1 (2000) must be verified.

External devices meeting EN60950 should be kept outside of the patient environment, as defined in IEC 60601-1-1 (2000).

Other external devices, such as laser cameras, printers, VCRs and external monitors, usually exceed allowable leakage limits and, when plugged into separate AC outlets that are then connected to the unit, are in violation of patient safety standards. Suitable electrical isolation of such external AC outlets may be required in order to meet UL-2601-1 and IEC 60601-1 (1988) standards for electrical leakage.

Allergic reactions to latex-containing medical devices

Due to reports of severe allergic reactions to medical devices containing latex (natural rubber), the FDA advises health-care professionals to identify latex-sensitive patients, and be prepared to treat allergic reactions promptly. Latex is a component of many medical devices, including surgical and examination gloves, catheters, incubation tubes, anesthesia masks and dental dams. Patient reaction to latex has ranged from contact urticaria, to systemic anaphylaxis.

For more details regarding allergic reaction to latex, refer to *FDA Medical Alert MDA91-1*, March 29.

Electromagnetic Compatibility (EMC)

*This unit carries the CE mark. The **Vivid 7/ Vivid 7 PRO** unit complies with regulatory requirements of the European Directive 93/42/EEC concerning medical devices. It also complies with emission limits for a Group 1, Class B Medical Device as stated in EN 60601-1-2 (2001) (IEC 60601-1-2 (2001)).*

All types of electronic equipment may characteristically cause electromagnetic interference with other equipment, transmitted either through air or connecting cables. The term Electromagnetic Compatibility (EMC), indicates the capability of the equipment to curb electromagnetic influence from other equipment, while at the same time not affecting other equipment with similar electromagnetic radiation.

Radiated or conducted EMC can cause distortion, degradation, or artifacts in the ultrasound image which could potentially obscure diagnostic information.

There is no guarantee that interference will not occur in a particular installation. If this equipment is found to cause or respond to interference, which may be determined by turning equipment on and off, qualified service personnel should attempt to correct the problem by one or more of the following measures:

- Re-orient or re-locate the affected device.
- Increase the separation between the unit and the affected device.
- Power the equipment from a source other than that of the affected device.
- Consult the service representative for further suggestions.

The manufacturer is not responsible for any interference or responses caused by the use of interconnecting cables other than those recommended, or by unauthorized changes or modifications to this unit. Unauthorized changes or modifications could void the user's authority to operate the equipment.

To comply with the regulations on electromagnetic interference, all interconnecting cables to peripheral devices must be shielded and properly grounded. Use of cables not properly shielded and grounded may result in the equipment causing or responding to radio frequency interference, in violation of the European Union Medical Device Directive and FCC regulations.

Do not use devices which intentionally transmit RF signals, for example, cellular phones, transceivers, or radio controlled

products, in the vicinity of this equipment as it may cause performance outside the published specifications. Keep the power to these types of devices turned off when near this equipment.

Environmental protection

System disposal

Please follow the disassembly procedure and part disposition attached inside the unit. To access to the procedure, remove the right side panel by unscrewing the two screws on the lower part.

Appendix

This chapter includes the following information:

• Product description 488
• Probe/Application overview 504

Product description

System Architecture

- TruScan architecture unleashes powerful imaging capabilities for the Vivid 7/Vivid 7 PRO. the Vivid 7/ Vivid 7 PRO is a complete digital cardiovascular color flow Doppler ultrasound system. The elements of TruScan are:
  - **TruData** - New 3D Beamforming technology significantly improves image quality with breakthrough performance in 2D, color and Doppler imaging.
  - **QScan** - Helps you extract more definitive diagnostic information from cardiovascular images by bringing quantitative assessment tools out of the research lab and into your routine clinical exam.
  - **TruAccess** - Gives you total data management with true, raw data DICOM networking capabilities to communicate your findings and to unlock your data for future quantitative analysis.
  - **ComfortScan** - Brings together an unprecedented level of ergonomic design and comfort with productivity software that allows operators to personalize their workspace.

Data Acquisition

- Cardiac, cardiovascular, abdominal, OB/GYN and OR optimized application presets
- High precision data acquisition
- Programmable open-ended system architecture
- Application-specific channel architecture: the Vivid 7/ Vivid 7 PRO employs a flexible digital beamformer architecture capable of using up to 1024 channels depending on specific application requirements
- 12 bit A/D converters per physical channel
- Digital data acquisition
- In addition to standard Curved Linear, Flat Linear, Phased Array and Doppler probes, it supports Active Matrix Array Curved (M12L) and Active Matrix Array Sector (M3S) probes
- Matrix probes allow tree-dimensional Digital Beamformer

algorithms for each mode

- Parallel data processing on four channels
- Receive focusing, aperture, apodization, and frequency response are all continuously variable as a function of depth

Data Processing

- TruScan architecture provides raw data management integrated into scan conversion processing
- PipeLink Technology: high speed parallel data bus for pre- and post-processing
- Echo data processing of phase, amplitude and frequency information
- Upgradable for future needs
- Raw data digital replay for retro and looping - allows for adjustment of all major display parameters and M & A

Display

- High resolution, flicker-free 17-inch computer graphics monitor, tilt and swivel
- 16.7 Million simultaneous colors available
- VCR input is played back through digital replay, allowing VCR images to be looped during review and M&A capability
- Instant review screen displays 12 simultaneous loops/ images for quick study review
- Scanplane position indicator and probe temperature are displayed with all multiplane TEE probes
- Image orientation marker
- Selectable display configuration of duplex and triplex modes: side-by-side or top-bottom, during live, digital replay and clipboard image recall
- Single, dual and quad-screen view

Ergonomics

- Floating keyboard with lifting swivel and in/out (Vivid 7 only) keyboard displacement
- Backlit keyboard

Display Annotations

- On-screen display of Mechanical Index (MI)
- On-screen display of Thermal Index
- Patient name/ID
- Hospital name
- Time/date
- Trackball driven annotation arrows
- Scanning parameters
- Active mode display
- Stress protocol parameters
- Parameter annotation follow ASE standard

Tissue Imaging

General

- Variable transmit frequencies for resolution/penetration optimization
- Display zoom with zoom area control
- High Resolution (HR) Zoom: concentrates all image acquisition power into selected Region of Interest (ROI)
- Variable Contour Filtering for edge enhancement
- Depth range up to 30 cm - probe specific
- Selectable greyscale parameters: Gain, Reject, DDP and Compress - can be adjusted in live, digital replay and image clipboard recall.
- Automatically calculated TGC curves require minimal operator interaction

2D-Mode

- Sector tilt capability
- Frame Rate in excess of 600 fps, depending on probe, settings and applications
- *Coded Octave Imaging* - 2nd generation harmonic tissue imaging providing improved lateral and contrast resolution over conventional imaging. Features reduced noise and improved wall definition. COI gives improved axial resolution without sacrificing frame rate, making it the tissue modality of choice for all patient groups.

- *Confocal Imaging* - allows for multiple transmit focal zones over range of view and a high vector density - probes dependent.
- Variable image width: a reduction either increases frame rate or increases the number of focal zones while maintaining the frame rate - application dependent
- *Real-time Compound Imaging* mode with linear arrays: for improved delineation of curved structures and speckle reduction without loss of any image resolution and increased field-of-view
- Dual Focus: a powerful tool giving additional focal zone for excellent spatial and contrast resolution from heart base to apical areas
- L/R and Up/Down invert, in live, digital replay or image clipboard recall
- Digital replay for retrospective review or automatic looping of images, allowing for adjustment of parameters such as gain, reject, Anatomical M-Mode, persistence and replay speed.
- Data Dependent Processing performs temporal processing which reduces random noise but leaves motion of significant tissue structures largely unaffected. Can be adjusted even in digital replay
- Colorized 2D-Mode, user selectable in real-time, digital replay

M-Mode

- Trackball Steerable M-Mode line available with all imaging probes, max steering angle is probe dependent.
- Simultaneous Real Time 2D- and M-Mode.
- M-Mode PRF 1 kHz, all image data acquired are combined to give high quality recording regardless of display scroll speed.
- Digital replay for retrospective review of spectral data
- Several top-bottom formats, side-by-side format and time-motion only format - can be adjusted in live and digital replay
- Selectable horizontal scroll speed: 1, 2, 3, 4, 8, 12, 16 seconds across display.
- Horizontal scroll can be adjusted in live or digital replay.

Anatomical M-Mode

- M-Mode cursor can be adjusted at any plane
- Curved Anatomical M-Mode: free (curved) drawing of M-Mode generated from the cursor independent from the axial plane
- Can be activated from live, digital replay or image clipboard recall
- Anatomical Color and Tissue Velocity M-Mode
- M & A Capability

Color Doppler

General

- Steerable Color Doppler available with all imaging probes - max steering angle is probe dependent
- Trackball-controlled ROI
- Removal of color map from the tissue during digital replay
- Digital replay for retrospective review of Color M-Mode data allowing for adjustment of parameters such as Encoding Principle, Color Priority and Color Gain even on stored data
- PRF settings - user selectable
- Advanced Regression Wall Filter gives efficient suppression of wall clutter
- For each encoding principle, multiple-color maps can be selected in live and digital replay - variance maps available
- More than 65,000 simultaneous colors processed, providing a smooth display two-dimensional color maps containing a multitude of color hues
- Simultaneous display of greyscale 2D and 2D with Color Flow
- Color Invert, user selectable in live and digital replay
- Variable Color Baseline, user selectable in live and digital replay
- Multivariate Color Priority function gives reliable delineation of disturbed flows even across bright areas of the 2D-Mode image
- Color Doppler frequency can be changed independently from 2D for optimal flow

Color Doppler Imaging

- Very high digital signal processing power, maintaining high frame rates with large ROIs even for very low PRF settings
- Frame Rate in excess of 100 fps, depending on probe and settings
- Variable ROI size in width and depth
- User-selectable Radial and Lateral Averaging for reduction of statistical uncertainty in the color velocity and variance estimates
- Data Dependent Processing (DDP) performs temporal processing and display smoothing with reduced possibility for loss of transient events of hemodynamic significance
- Digital replay for retrospective review or automatic looping of color images, allowing for adjustment of parameters such as DDP, encoding principle, baseline shift, color maps, color priority and color gain even on frozen/recalled data
- Application dependent Multivariate Motion Discriminator reduces flash artifacts
- Dedicated coronary flow application

Color Angio (Color Intensity Imaging)

- Angle independent mode for visualization of small vessels with increased sensitivity compared to standard color flow

Color M-Mode

- Variable ROI length and position - user selectable
- User-selectable Radial Averaging for reduction of statistical uncertainty in the color velocity and variance estimates
- Selectable horizontal scroll speed
- 1, 2, 3, 4, 6, 8, 12, 16 seconds across display - can be adjusted during live, digital replay or image clipboard recall
- Real-time 2D image while in color M-Mode
- Same controls and functions available as in standard 2D color Doppler

Anatomical Color M-Mode™

- Vingmed-patented any plane Color M-Mode display derived from Color Doppler cineloop.
- Also applicable to Tissue Velocity Imaging

- M&A capability

Spectral Doppler

General

- Operates in PW, HPRF, and CW modes
- Trackball Steerable Doppler available with all imaging probes - max steering angle is probe dependent
- Selectable Doppler frequency for better optimization
- High-Quality Real-time duplex or triplex operation in all Doppler Modes, CW and PW and for all velocity settings
- Frame Rate Control for optimized use of acquisition power between spectrum, 2D, and Color Doppler Modes in duplex or triplex modes
- Very fast and flexible spectrum analysis with an equivalent DFT rate of 0.2 ms
- Dynamic Gain Compensation for display of flows with varying signal strengths over the cardiac cycle and improved ease of use
- Dynamic Reject gives consistent suppression of background - user selectable, in real-time, digital replay or image clipboard recall
- digital replay for retrospective review of spectral Doppler data
- Several top-bottom formats, side-by-side format and time-motion only format - can be adjusted in live or digital replay.
- Selectable horizontal scroll speed: 1, 2, 3, 4, 6, 8, 12, 16 seconds across display - can be adjusted in live or digital replay
- Adjustable spectral Doppler display parameters: Gain, Reject, Compress, Color Maps - can be adjusted in live or digital replay
- User-adjustable baseline shift - in live, digital replay and image clipboard recall
- Adjustable velocity scale
- Wall filters with range 10 - 2000 Hz (velocity scale dependent)
- Angle correction with automatic adjustment of velocity scale - in live, digital replay and image clipboard recall

- Stereo speakers mounted in the front panel
- Display annotations of frequency, mode, scales, Nyquist limit, wall filter setting, angle correction, acoustic power indices

PW / HPRF Doppler

- Automatic HPRF Doppler maintains its sensitivity even for shallow depths and with the highest PRFs
- Digital Velocity Tracking Doppler employs processing in range and time for high-quality spectral displays
- Adjustable sample volume size of 1-20 mm (probe dependent)
- Maximum sample volume depth 30 cm

CW Doppler

- Highly sensitive steerable CW available with all phased array probes

Tissue Velocity Imaging

- Myocardial Doppler Imaging with color overlay on tissue image
- Digital Velocity profile analysis allowing velocity and time quantification at any point and at any time during the heart cycle from digital replay or image clipboard recall
- Quantitative Segmental Wall Motion Analysis can be obtained with use of Anatomical M-Mode, from digital replay or image clipboard recall
- The velocity of all myocardial segments after entire heart cycle can be displayed in one single image
- Tissue color overlay can be removed to show just the 2D image, still retaining the tissue velocity information
- Quantitative profiles for TVI, Tissue Tracking, Strain (Vivid 7 only) and Strain Rate (Vivid 7 only) can be derived

Tissue Tracking

- Real time display of the time integral of TVI for quantitative display of myocardial systolic displacement
- Myocardial displacement is calculated and displayed as a color-coded overlay on the 2D image - different colors represent different displacement ranges

Strain rate/Strain imaging (option, Vivid 7 only)

Research

- Rate of tissue deformation is calculated and displayed as real time color-coded overlay on the 2D image
- Tissue deformation (Strain) is calculated and displayed as real time color-coded overlay on the 2D image
- Cine compound calculates and displays cineloops generated from a temporal averaging of multiple consecutive heart cycles
- Anatomical M-Mode and Curved Anatomical M-Mode displays (SI and SRI)

Physiological Traces

- Up to five traces display simultaneously
- ECG trigger
- ECG lead selection
- High-resolution display of the following traces: ECG, Respiration, Phono, AUX1 and Pressure/AUX2

Analysis Program

- Personalized measurement protocols allow individual set and order of M&A items
- Measurement can be labelled seamlessly by using protocols or post assignments
- Bodymark icons for location and position of probe
- Cardiac calculation package including extensive measurements and display of multiple repeated measurements
- Vascular measurements package
- Measurements assignable to protocol capability
- Parameter annotation follow ASE standard
- Measurements assignable to report generator
- Doppler auto trace function with automatic calculations in both live and digital replay
- Possibility of performing Measure and Analysis on video playback

- Seamless data storage and report creation
- Measurements are summarized in worksheets - individual results can be edited or deleted
- User-assignable parameters

User Interface

- Easy-to-learn user interface with intelligent keyboard
- Front panel with application-specific rotaries and push buttons for primary controls
- Application-specific secondary controls available through slidebars operated by a four-way rocker
- Slide pot TGC curve with eight pots
- Overall gain for 2D-Mode, Active mode, Depth and Zoom Span on dedicated rotaries
- Digital harvesting of images and loops into image clipboard
- Patient Browser Screen for registration of demographic data and quick review of Image Clipboard contents
- Fully programmable user presets for probe/application default settings
- Standby function for fast bootup
- Support for international (European) keyboard character sets (ISO 8859)

Wideband probes

- Electronic selection between three solid state and one stand-alone Doppler connectors
- Parking position for additional solid state probe
- Biopsy support for 3.5C and 12L probes

Probe	Freq. Range	Cat. #
Phased Array Sector		
M3S[a]	1.5 - 4.0MHz	H45011SZ
3S	1.5 - 3.6 MHz	H4550SZ
5S	2.2 - 5.0 MHz	H4901RA
7S	3.0 - 8.0 MHz	H4000P

Probe	Freq. Range	Cat. #
10S	4.0 - 12.0 MHz	H4901PCS
Linear Array		
7L	3.2 - 7.5 MHz	H40212LF
10L	4.0 - 11.0 MHz	H40212LG
12L	5.0 - 11.5 MHz	H40412LH
M12L[a]	6.0 - 13.0 MHz	H40412LD
i8L	5.0 - 8.0 MHz	H45511NW
i13L	8.0 - 13.0 MHz	H45511NT
Curved Array (Convex)		
3.5C	2.4 - 5.0 MHz	H4901PE
5C	3.6 - 8.0 MHz	H40412A
M7C	3.0 - 8.0 MHz	H40412LC
8C	4.0 - 10.0 MHz	H40412LJ
E8C	4.0 - 10.0 MHz	H40412LD
Doppler		
2D (P2D)	2.0 MHz	H4830JE
6D (P6D)	6.0 MHz	H4830JG
Multiplane Transesophageal Phased Array[b]		
6T	2.9 - 6.7 MHz	H45001YD
7T	3.0 - 8.0 MHz	H45521DX
8T	3.3 - 8.0 MHz	H45001YE
9T	3.3 - 10.0 MHz	H45521DY

a) Vivid 7 only

b) TEE probe adapter allows using PAMPTE and 6Tv which are designed for System FiVe and Vivid FiVe scanners

Image Management

- TruAccess: ultimate workflow with instant access data

management

- Next generation of DICOM image format: raw image DICOM incorporates raw image data information with all its data management flexibility into the image communication standard DICOM
- 2D, CFM or TVI data at maximum framerate may be reviewed by scrolling or by running cineloops
- Image Clipboard for stamp-size storage and review of stored images and loops
- Built-in patient archive with images/loops, patient information, measurements and report
- Configurable HTML-based report function
- Internal archive can be exported to Removable Image Storage through Magneto-Optical Disk and DICOM Media
- Internal Hard Disk: for storing programs, application defaults, ultrasound images and patient archive
- All data storage is based on ultrasound raw data, allowing to change gain, baseline, color maps, sweep speeds etc., for recalled images and loops
- DICOM media: read/write images on DICOM format
- Alphanumeric patient data can be exported in MS Excel compatible format
- AVI and JPEG export

Advanced Options

Contrast Imaging (option)

Real Time Myocardial Contrast Imaging (RTMC) Research (Vivid 7 only)

- Low power dynamic imaging of myocardial contrast
- Simultaneous visualization of wall motion and myocardial contrast
- Destruction and replenishment using flash imaging
- Frame rates up to 30 Hz
- Probe dependent: M3S

Myocardial Contrast (MC) Application[1]

- Based on 2nd harmonic Imaging, optimized for amplitude-sensitive detection of contrast-specific signals within the

myocardium in ECG-triggered mode
- Available in 2D Tissue harmonic imaging and Color Angio
- Probe dependent: M3S, 3S, 5S

Left Ventricular Contrast (LVC)[1]
- Based on 2nd harmonic imaging optimized for visualization of contrast in LV
- Probe dependent: M3S, 3S, 5S, 6T

1) Harmonic Imaging for supporting contrast agent imaging was developed by Schering.

EchoPAC PC

- EchoPAC PC adds connectivity and image analysis capability to Vivid 7/Vivid 7 PRO
- Instant access to ultrasound raw data provided by the system
- Advanced Post-Processing Analysis
- MO drive
- CD writer

EchoStress (option)

- Advanced and flexible stress-echo examination capabilities
- Provides exercise and pharmacological protocol templates
- Template editor for user-configuration of existing templates or creation of new templates
- Reference scan display during acquisition for stress level comparison (dual screen)
- Raw data continuous capture
- Wall motion scoring (bull-eye and segmental)

Q Analysis (option)

Quantitative TVI/SRI/SI/TT analysis

SRI, SI and TT are available on Vivid 7 only
- Multiple Time-motion trace display from selected points in the myocardium
- Arbitrary curved Anatomical M-Mode
- Offline postprocessing with comprehensive image

adjustment capabilities of TVI, TT, SRI and Strain imaging data

Quantitative Contrast analysis

Post processing on Contrast Harmonic images (2D and Angio data)

- Time-Intensity Analysis: allows instant time-intensity calculation from up to eight regions of interest
- Curve-fitting Analysis: for research studies of myocardial perfusion rates using contrast agents
- Offline ECG triggering from Real time data
- Arbitrary curved Anatomical M-Mode
- Spatial Profile: displays the intensity profile along the anatomical M-Mode path

Quantitative Stress analysis

Provides three different analysis tools based on TVI data stored during stress acquisition

- Optional Tissue Tracking velocity data can be acquired in the background of 2D stress protocols - this allows stress quantification that provides three different analysis tools:
  - **Tissue Tracking** - enables visualization of the heart contraction at peak level by color-coding the displacement in the myocardium
  - **Vpeak measurement** - enables the display of a tissue velocity trace for a selected region of a previously scored segment through the entire heart cycle
  - **Quantitative analysis** - enables further quantitative analysis based on multiple tissue velocity traces

EchoDICOM (option)

- Ethernet network connection
- DICOM support
- *Storage* to DICOM Server
- Modality Worklist: gives access to a list of patients from a worklist server (usually HIS)
- Storage commitment
- Performed Procedure Step
- Verify: provides verification of an active connection

between the scanner and another DICOM device

Peripherals (options)

Internal peripherals

- SVHS VCR
  - Full control from system panel
  - Frame grabber for playback
  - M&A package for video measurements
- B/W video printer with control from system panel
- Color video printer with control from system panel

External

- Ink-jet printer

Physical Dimensions

Size	Metric	Imperial
Height[a]	137.5 cm 157.5 cm	54.1 in 62 in
Width	64.0 cm	25.2 in
Depth	90.0 cm	35.4 in
Weight[b]	190 kg	419 lbs

a) with monitor

b) with monitor, without peripherals

Cart

- Low rolling resistance casters
- Brakes on front casters
- Direction of casters can be locked for improved maneuverability
- Intelligent Fans: revolution speed is automatically adapted to the system's internal operating temperature

Electrical Specifications

Voltage (VAC)	Frequency (Hz)	Current (A)
100-120	50–60	10
230	50–60	5

Safety

- Built to meet the requirements of:
  - IEC 60601-1 (1988)
  - UL 2601-1
  - The European Medical Devices Directive (MDD) 93/42/EEC (CE Mark)
  - The Vivid 7/Vivid 7 PRO ultrasound unit is a Class I device, type CF, according to Sub-clause 14 of IEC 60601-1 (1988).
  - The Vivid 7/Vivid 7 PRO ultrasound unit meets the EMC requirements in EN 55011 (1991/1998) for Group 1. Class B (10 meters)

△
CAUTION

Not all features or products described in this document may be available or cleared for sale in all markets. Please contact your local GE Medical Systems representative to get the latest information.

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Probe/Application overview

Application	Probe															
	3S	M3S	5S	7S	10S	7L	10L	12L	M12L	i8L	i13L	3.5C	5C	M7C	8C	E8C
Abdominal	+	+										+	+	+	+	
Arterial						+										
Cardiac	+	+	+	+	+					+	+					
Carotid						+	+	+	+							
Coronary	+	+	+	+	+											
Exercise	+	+														
Fetal Heart[a]	+	+	+	+								+	+			+
LV Contrast	+	+	+													
LVO Stress		+														
MC Contrast	+	+	+													
Octave SRI		+														
Obstetrics[a]												+	+			+
Pediatric	+	+	+	+	+											
Pelvic												+	+			+
Q-Stress	+	+														
Real Time MC		+														
Renal	+	+										+	+			
Small rodent					+			+			+					
Q-Stress	+	+														
Transcranial	+	+														
Superficial							+	+	+							

Only the applications marked with a “a” are approved for fetal use when appropriate probe is selected.

Application	Probe															
	3S	M3S	5S	7S	10S	7L	10L	12L	M12L	i8L	i13L	3.5C	5C	M7C	8C	E8C
Venous						+	+									
Only the applications marked with a “a” are approved for fetal use when appropriate probe is selected.																

Application			Probe														
	2D	6D	5T	6T	8T	9T	PAMPTE										
Abdominal																	
Arterial																	
Cardiac	+		+	+			+										
Carotid		+															
Coronary			+														
Exercise																	
Fetal Heart[a]																	
LV Contrast			+														
LVO Stress																	
MC Contrast			+	+			+										
Octave SRI																	
Obstetrics[a]																	
Pediatric					+	+											
Pelvic																	
Q-Stress																	
Real Time MC																	
Only the applications marked with a “a” are approved for fetal use when appropriate probe is selected.																	

Application			Probe														
	2D	6D	5T	6T	8T	9T	PAMPTE										
Renal																	
Small rodent																	
Q-Stress																	
Transcranial																	
Superficial																	
Venous																	
Only the applications marked with a “a” are approved for fetal use when appropriate probe is selected.																	

△
CAUTION

GE recommends dedicated probes for use on humans only or animals only. Mark probes dedicated for animals only with special labels.

If probes are interchanged between humans and animals, GE strongly recommends that the probes are sterilized between transitions humans / animals. Observe any national rules and regulations for handling equipment used on both animals and humans. Such national restrictions may prohibit transfer of probes used on animals to humans and vice-versa.

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